

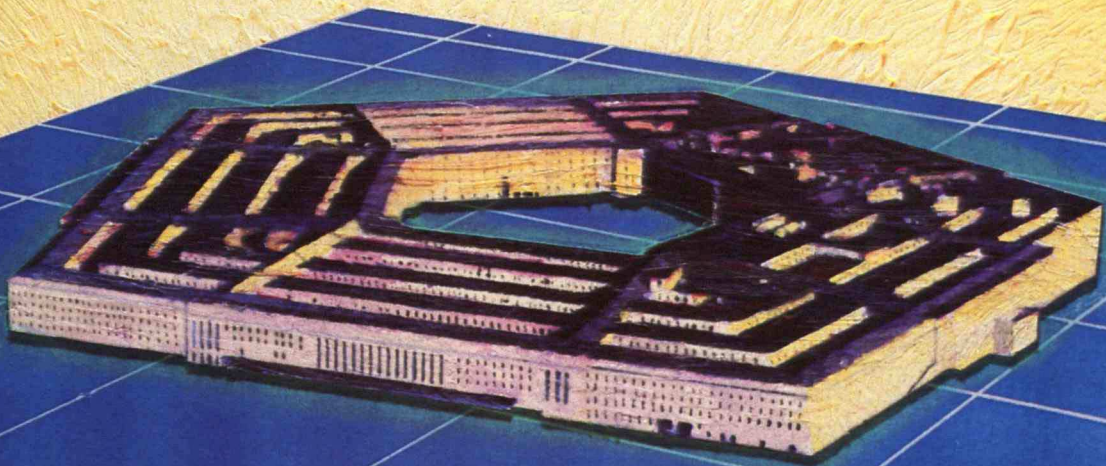
Technology Review

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MAY/JUNE 1991

\$3.00

AFTER THE GULF
★ ★ ★ ★
**THE NEW
MILITARY
PARADIGM**
★ ★ ★ ★



ALSO IN THIS ISSUE:

- ★ *NAE'S ROBERT M. WHITE ON THE CRISIS IN RESEARCH FUNDING*
- ★ *CONSUMING MORE AND ENJOYING IT LESS*
- ★ *WHAT ACTUALLY CAUSES CANCER*

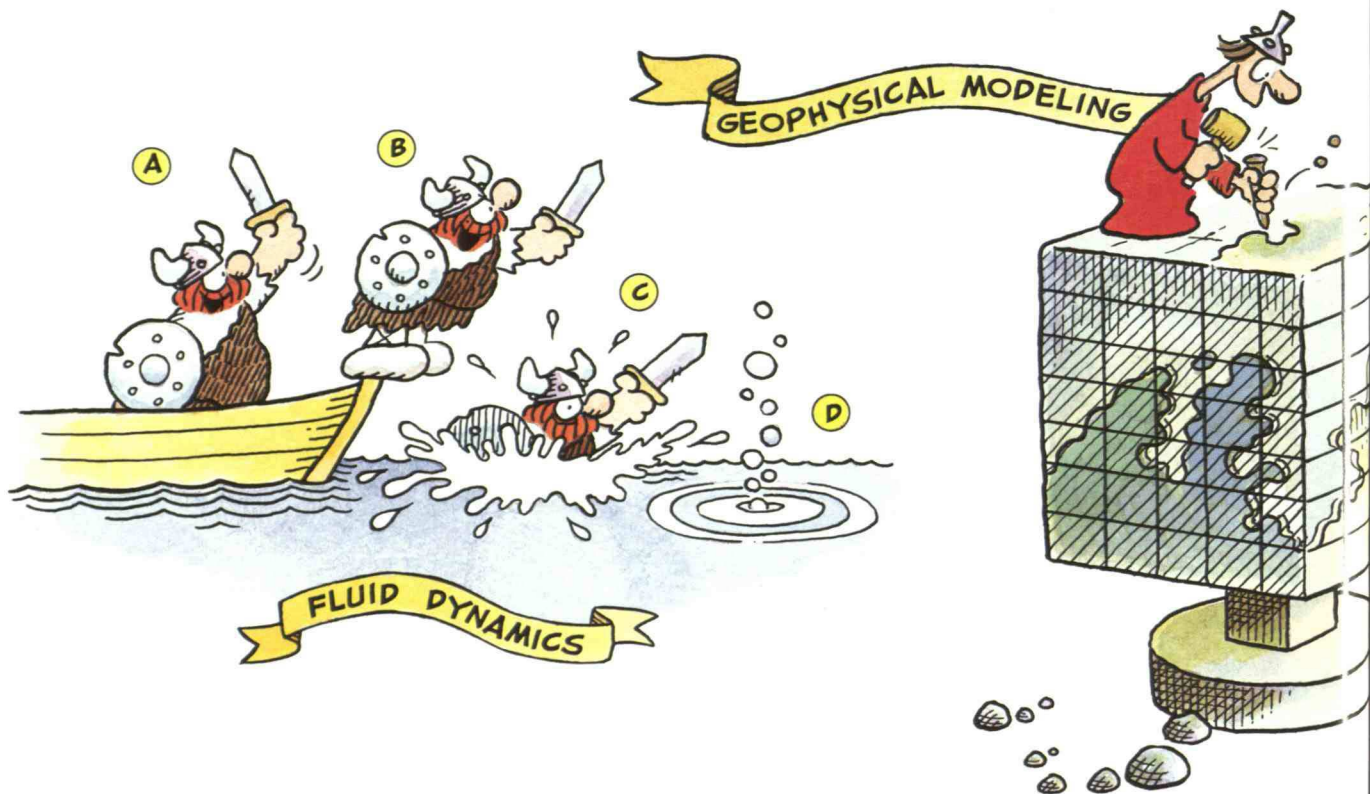


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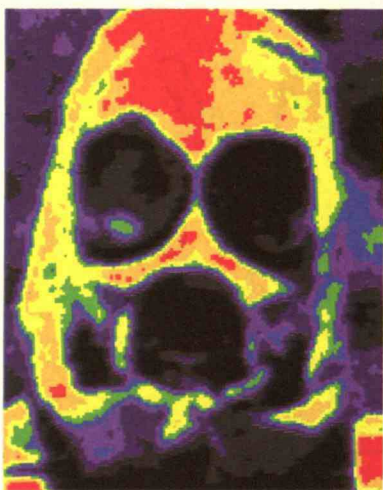
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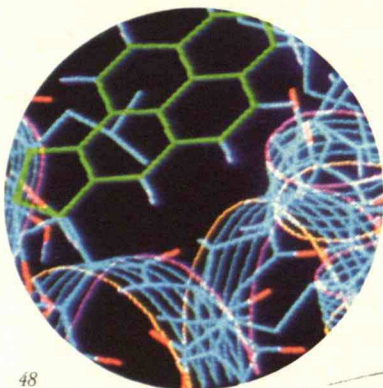
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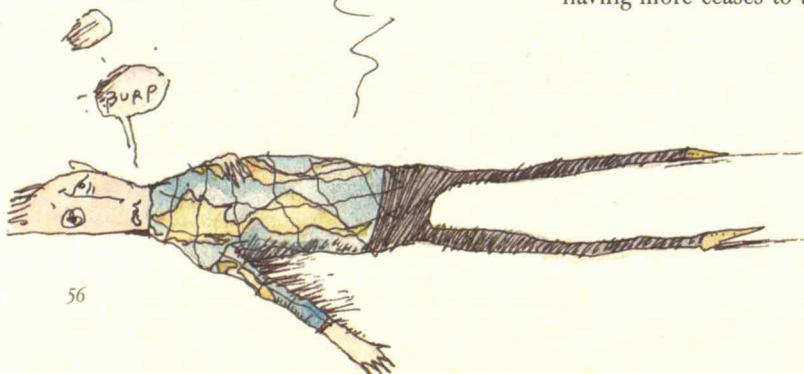
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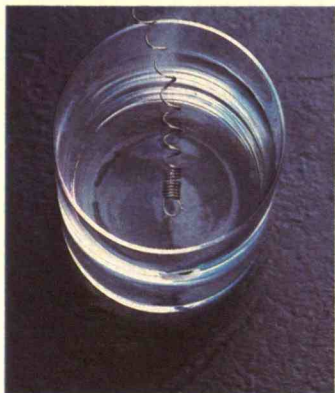
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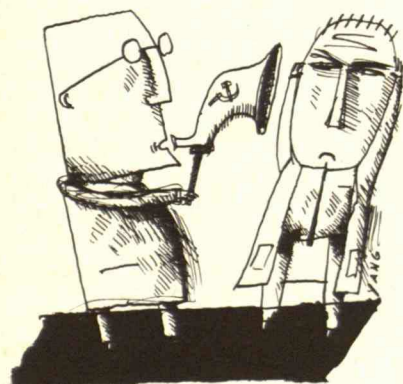
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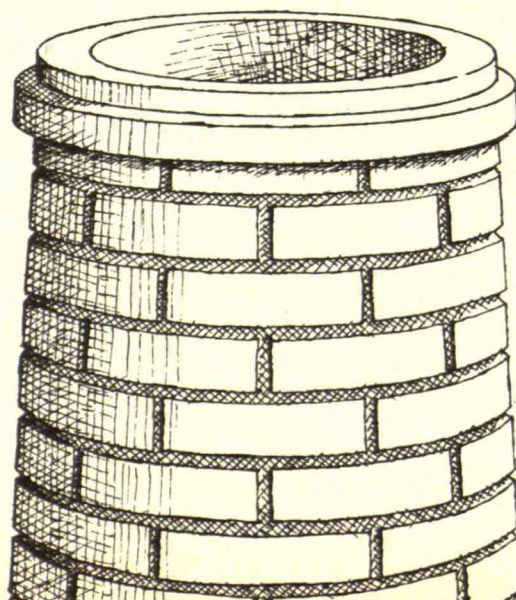
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The Innovation Economy

DESPITE a state unemployment rate that has reached almost 10 percent, the city of Boston recently released *The Howell Report* predicting an ebullient economic future for the area. James Howell, author of the report and former chief economist for the Bank of Boston, bases his optimism on the conviction that the region holds "the key to success," namely "the ability to innovate." As a result, he predicts that the Boston area will enjoy 400,000 new jobs and rapidly rising incomes in the 1990s. Howell's predictions may actually turn out to be right, but his promised land of the innovation economy—a vision that is widely shared across the nation—looks largely like a mirage.

The argument that Howell distills from several sources (including most recently Harvard Business School professor Michael Porter's *The Competitive Advantage of Nations*) holds not only that the innovation economy will bring success, but that government can somehow foster such an economy. At least for Boston, the public sector's "central preoccupation," Howell says, "must be the creation and maintenance of an environment for innovative investment."

He falls short in spelling out what governments should actually do. Besides recommending maintaining the infrastructure and avoiding fiscal ineptitude—the minimum for any government—he advocates the old nostrum of a "positive business climate." This means simpler regulation, something anyone who has tried to get a permit in this state will applaud, plus tax breaks for business, a dubious proposition. Why give a few percent credit for investment? Such minor cost savings will not make a firm globally competitive. The reason for awarding such tax breaks is that firms might move north if New Hampshire offers a better tax package. So this advice boils down to

recognizing the unfortunate need for Massachusetts to play the tax-cutting game that all states jointly lose.

Oddly, Howell omits a few steps that government could take to foster the characteristics that he names as essential for the innovation economy. He points to world-class research institutions and the technologists and managers they produce. Around Boston these institutions are private, but as California has shown, governments can build comparable establishments. Howell also cites a need for entrepreneurial spinoffs, a strong venture capital industry, effective banks, and

*There are
a few winners
and many losers.*

good business services. Massachusetts government actually has contributed in these areas. For example, the Massachusetts Technology Development Corporation has successfully operated as a venture-capital firm while meeting economic-development goals established by the legislature.

But seeking prosperity solely through innovation is the Horatio Alger approach. Almost by definition there are a few winners and many losers. Howell himself notes that "knowledge-based" cities "have naturally tended to emerge in a relatively small number of places" such as Boston, Silicon Valley, Minneapolis-St. Paul, and Los Angeles. The innovation economy offers most of the world dim hope.

Even metropolitan areas that qualify as knowledge-based must run very hard to stay still. Howell emphasizes that the diversity of Massachusetts' innovative industries—computers, biomedical, business service, education—stabilizes the economy and softens downturns. But in the few months since his report was released, that assertion has been disproved. The current recession

has seen the greatest percentage of job loss in Massachusetts since the 1930s. The knowledge-based economy easily stumbles.

If innovation does produce a boom in the 1990s, will that benefit all Boston's residents, as Howell hopes? He pays the usual tribute to the need for improving the Boston city schools so their graduates can participate in economic growth. However, when it comes down to citing the essential characteristics of the knowledge-based city, he forgets about public education. Howell even quotes Michael Porter that "cost and availability of basic factors such as labor [presumably non-college educated labor] no longer necessarily account for competitive strength." The fact is that Howell's innovation economy needs universities but could manage almost without local public-school graduates.

A recent study by Boston's own Economic Development and Industrial Corporation projecting job growth through 1995 in biomedical fields, a touted innovative area, demonstrates the small need for high-school graduates. Some 64 percent of Boston area residents between the ages of 20 and 34 lack four-year college degrees. These people will be competing for only 25 percent of the biomedical jobs.

The Massachusetts boom of the 1980s left large areas untouched. Dilapidated and abandoned apartments along Blue Hill Avenue in Roxbury remain much as they were. Families from poor areas run out of food stamps at the end of the month and go hungry. The main sign of prosperity is the occasional \$40,000 Volvo or BMW bought with drug profits. Why should a boom in the 1990s be different?

Innovation is important: better vaccines protect people from diseases; better machinery improves the environment. Innovation can play a role in helping some economies, including Boston's. But a universal and desperate search for never-ending innovation is no answer to economic welfare.

JONATHAN SCHLEFER

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Letters

COMING TO TERMS WITH THE GULF WAR

In "Defense Against What?" (*TR First Line, January 1991*), Jonathan Schlefer offers an anemic pastiche of thoughts that are elliptical at best and intellectually dishonest at worst, and he uses them to back up the pompous conclusion that "massive U.S. military forces are now superfluous." He doesn't bother to examine the quagmire of politics, culture, and religion that has led the Mideast and the allies to their current condition. Nor does he provide a thoughtful alternative to military power.

The crux of his unwholesome foray is that public opinion must be in solid agreement if the United States is to go to war. Since we have all grown up with the assumption that in a democracy the will of the people is rarely unanimous or solid, I am left wondering what solid agreement is and how Mr. Schlefer proposes to make it a standard part of our governance.

Moreover, the article misrepresents history. John Foster Dulles (the master of brinkmanship) and John F. Kennedy (who invoked the spectre of nuclear annihilation to keep the Soviets at bay during the Cuban missile crisis) would no doubt have been surprised to learn that using military threats as an extension of diplomatic pressure died with nineteenth-century Prussia.

Mr. Schlefer has his obtuse moments as well. Protecting oil supplies may or may not be worth a war, but to say that fighting such a war is the same as asking Americans to die over the *price* of oil is to play fast and loose with the difference between global security and global economics. Recall the early '70s, when Arab nations were largely responsible for oil price increases that were even greater than those of today (on a relative scale). Does anyone seriously believe that Western nations ever would have issued a call to war over such price increases?

And as for the lament that only 3,000 of 70,000 exiled Kuwaitis volunteered to risk their lives in the Persian Gulf war, so what? Does the decidedly higher number of volunteers among the Iraqi

populace mean that Iraq would have made a better ally? Perhaps the sampling of Kuwaitis should have been broadened by asking the hundreds of thousands who remained at home as virtual prisoners of war to identify themselves and declare their intentions to reclaim their country.

Finally, the article is just plain silly at times. According to Mr. Schlefer, we should have avoided reacting to Saddam Hussein's nuclear threat—that way we would have ensured that the next megalomaniac to come along wouldn't know enough to keep the nuclear strategy close to the vest. . . . "Megalomaniacs who have Learned How To Lie about their Ambitions! on the next 'Geraldo.'"

The Mideast teems with dark and puzzling issues. The situation in the Persian Gulf is grave and disturbing, and it deserves more than the involuntary spasms of a writer's patella. For those of us seeking moral sustenance during these troubled times, Mr. Schlefer's article is thin gruel in a shallow bowl.

HARRY ZANE
Glen Mills, Pa.

The author responds:

Mr. Zane's complaints seem tangential to my argument. For example, of course I didn't examine the quagmire of politics, culture, and religion that has brought the Mideast to its current state. That would take a book, and I couldn't write it. The vast majority of Americans know practically nothing about the area—one reason for caution. Launching an invasion seems to call for detailed knowledge of the situation and the likely effects of violence. Yet the Bush administration displayed its ignorance by resisting congressional efforts before last August to classify Iraq as a terrorist nation.

To respond to other points more briefly: Yes, solid congressional support for anything is rare, but I think it should be required before embarking on the massive legalized killing of war. I know U.S. brinkmanship occurred—I just don't think it was wise. Protecting a portion of world oil supplies and protecting oil prices are the same thing. And finally,



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LETTERS

I didn't say the United States should not react to nuclear-weapons proliferation. I said bombing nuclear facilities is a poor way to do that.

I still do not think that massive military forces had to be used in Iraq. Although U.S. military commanders demonstrated competence, I remain disappointed that political leaders asked them to do so. I would have preferred patience—a blockade and other sanctions—to the massacre of 50,000 to 100,000 Iraqis and a few U.S. soldiers. I realize I am in a minority of Americans, but I hope that in the future we will find pride in more humane actions.

DEFENDING COMPUTER LITERACY

During the past few years, there have been dozens of reports documenting the sorrowful state of science education in elementary schools. Does that mean that we should eliminate science from elementary schools?

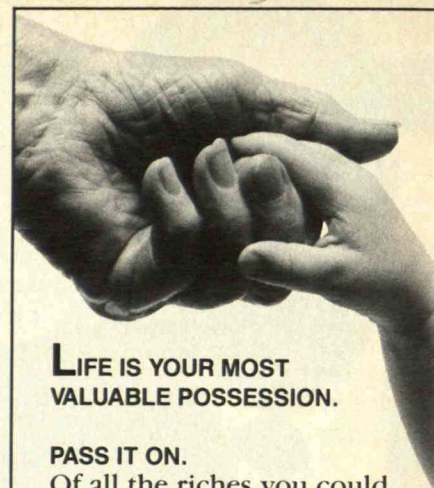
Of course not. But "Debunking Computer Literacy" by Ronni Rosenberg (*TR January 1991*) uses the same faulty logic in discussing the role of computers in schools. The article provides some strong evidence that today's schools often use computers in trivial, meaningless ways. However, this is hardly reason to argue that education in computer literacy should be delayed until high school and that it should focus only on social and political issues.

Rather, we need to develop a new mindset about computers—and about education in general. We need to create opportunities for children to work on personally meaningful projects. Computers can play a powerful role in such projects, enabling children to engage in a new array of creative and intellectually enriching activities.

MITCHEL RESNICK
Cambridge, Mass.

PEANUT BUTTER IN PERSPECTIVE

In the opening sentence of "Terminal Hazards" (*February/March 1991*), Ann Claire Greiner quotes a *PC Magazine* column by Winn L. Rosch. What Rosch actually says in this column is that a peanut butter sandwich is more dangerous than a video display terminal



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(VDT), but what Greiner implies is that he says peanut butter and VDTs are equally harmless.

Peanut butter does indeed present a health risk. Aflatoxin, a carcinogenic mold metabolite, occurs in peanuts and peanut products owing to natural growth of mold in the crop before harvest. There is a controversy about the magnitude of the risk, and about appropriate means to minimize it, but not about the existence of the risk.

Extensive testing by peanut processors helps keep the aflatoxin level in peanut butter well below the 20-parts-per-billion limit set by the Food and Drug Administration, but peanut butter consistently contains 2 to 5 parts per billion. Moreover, drought in the southeast United States caused unusually high aflatoxin levels in the 1990 peanut crop.

Rosch was clearly aware of aflatoxin

while comparing risks from VDTs and peanut butter (as well as from cigarette smoke and cholesterol, other well-established hazards). Greiner apparently was not aware of any such thing.

TOM HANSEN
Somerville, Mass.

TECHNOLOGY AND FINGERS

I read "Hands That Hurt" by Barbara Goldoftas (*TR January 1991*) with both interest and sympathy. Several years ago, I was suffering the agonizing limitations of carpal tunnel syndrome in both hands. There was no doubt about my condition: I had all the tests including electromyography, I had intractable pain, and three fingers on my right hand were totally numb. I could barely open a door, hold a fork, or comb my hair.

Two top neurosurgeons in the Philadelphia area told me that unless I

had surgery, I would never regain either feeling or ability in my hands. But as a pianist, I did not regard surgery with much enthusiasm, so I refused to go ahead with it and decided instead to follow the simple but safe treatment recommended by *Prevention* magazine—100 milligrams of vitamin B6 twice a day for two months, more or less. Since then I have been completely symptom-free and am playing the piano better than ever.

PATRICIA WOOD
Wynnewood, Pa.

CORRECTION

"Coral Grief" by Katherine Muzik (*TR April 1991*) includes a map that shows the locations of coral reefs worldwide. The credit for that map should have gone to *Corals of Australia and the Indo-Pacific* by J.E.N. Vernon.

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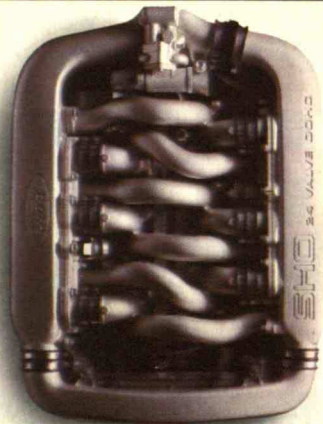
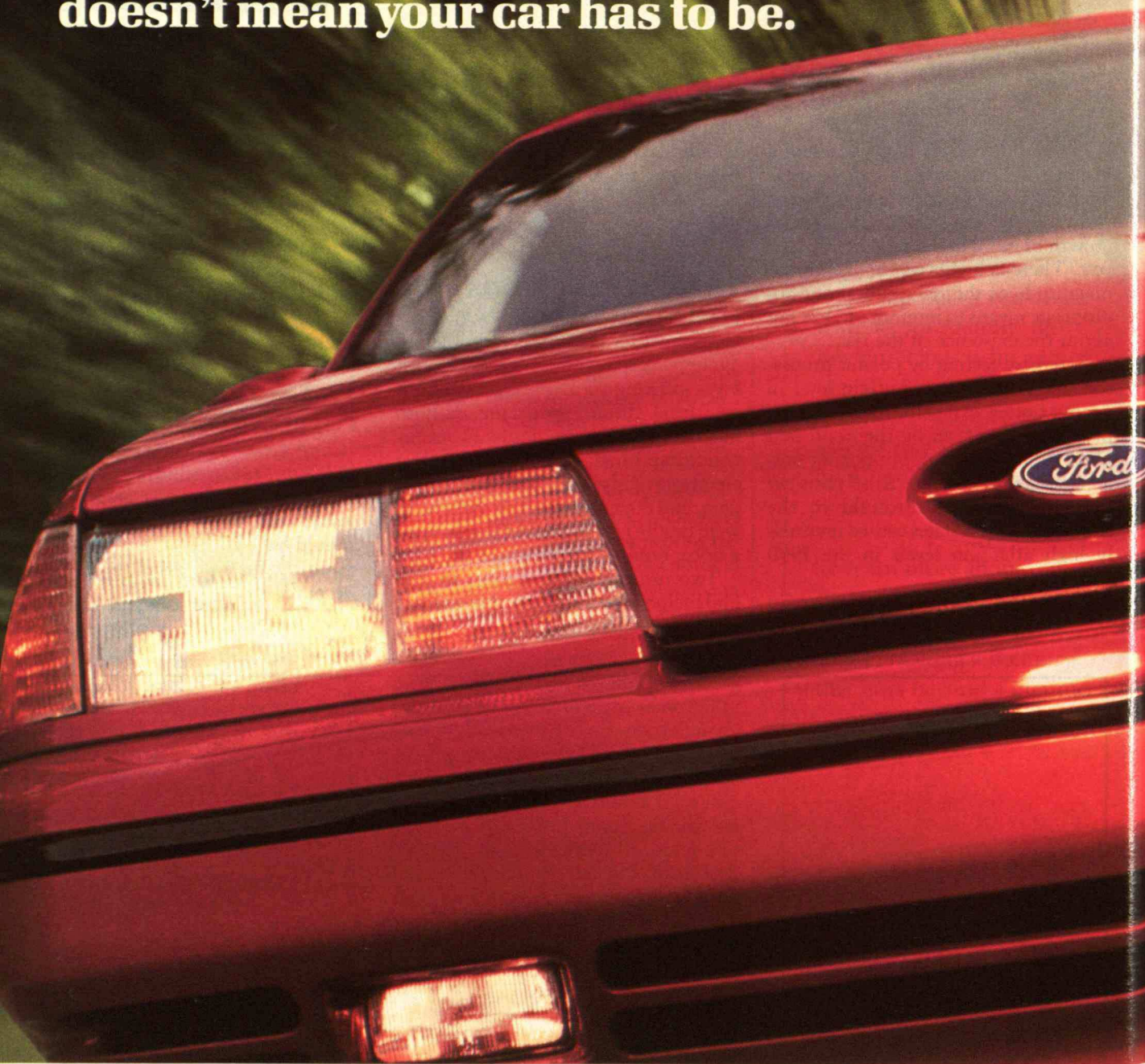
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MIT Reporter

COMPUTERIZED VISION

 Thousands of people in the United States are blinded each year by diseases that attack the eye's light-gathering cells. Two of the diseases, macular degeneration and retinitis pigmentosa, are the leading causes of blindness in the country, having left several million people with moderate to severe loss of vision. Researchers at MIT and Massachusetts Eye and Ear Infirmary are working on a tiny computer chip that may someday restore these victims' sight.

A light-sensitive microchip might handle the function served by the "photoreceptor" cells in the retina—the eye's back surface. Normally, photoreceptor cells translate light waves into electrical impulses and send them to the brain via other retinal cells. In place of dysfunctional photoreceptors, it might be possible to implant a chip containing an array of stimulating electrodes onto the retina. Linked to nerve cells, the chip's electrical circuits might be able to send signals about visual information to the brain.

"At the beginning, we're hoping for simple vision" that will allow people to tell light from dark and distinguish rough shapes, says Joseph Rizzo, a Massachusetts Eye and Ear neuro-ophthalmologist working on the chip project. "But the technology exists for building chips that could achieve a remarkable degree of detail, perhaps sufficient for reading."

Doctors are already using microchips to treat hearing loss, and some researchers have employed them to help paralyzed people walk a few steps. Men with spinal cord injuries have even fathered children thanks to electro-ejaculation techniques.

It makes sense to implant microchips onto the retina, says John Wyatt, an MIT electrical engineering professor who is also involved in the research. That's because that part of the eye does its job "early in the vision process and we have some idea what is going on there." The chip's main function would



In the future, implanted light-sensitive computer chips may help some blind people see.

be gathering light and generating an electrical signal to stimulate the retina. The device would have to do much less signal processing than if it were used to replace cells that come into play later in the vision process, according to Wyatt.

Still, the team must solve some formidable problems before trying the procedure in people. One of the most difficult may be figuring out how to attach a chip to the retina, which has the consistency of wet tissue paper. "You need to fix the chip in place so it doesn't wiggle around, but you can't use much force, because that would damage the delicate retina," Rizzo explains. Experiments with rabbits have been inching toward the right surgical techniques.


The researchers are also concerned about how a chip will fare in the eye's salty fluid. "We not only have to worry if the eye can survive the implant, but whether the implant can survive the

eye," notes David Edell, a principal research scientist with the Harvard/MIT Division on Health, Science, and Technology, and another key researcher with the project. Salt water slowly erodes chip surfaces and can interfere with electronic circuits, and small changes in conductivity can be just as damaging as total failure. One of Edell's current projects is to analyze how well different polymer coatings protect microchips in salt water.

The retina chip is an "interesting approach" to using electrodes for vision problems, says F. Terry Hambrecht, who heads the neural prosthesis program at the National Institute of Neurological Disorders and Stroke. He is trying to determine the feasibility of providing sight to blind people by implanting electrodes the width of a hair in the brain. These electrodes would stimulate the visual cortex and in theory could receive images from a small camera acting as a pair of eyes.

Hambrecht points out that the field of electronic microprosthetics presents many challenges, and Rizzo and Wyatt agree. "But if this works," says Rizzo, "it will be spectacular for blinded patients."—By P.J. SKERRETT, a freelance science writer ■

MORE ELECTRICITY, LESS POLLUTION

 Coal, the most abundant fossil fuel in the United States, has long been used to generate electric power. Of course, the pollution it produces is severe. But new technology for combining coal with natural gas—the cleanest fossil fuel—could produce electricity efficiently with much less pollution, says János M. Béer, an MIT chemical engineering professor.

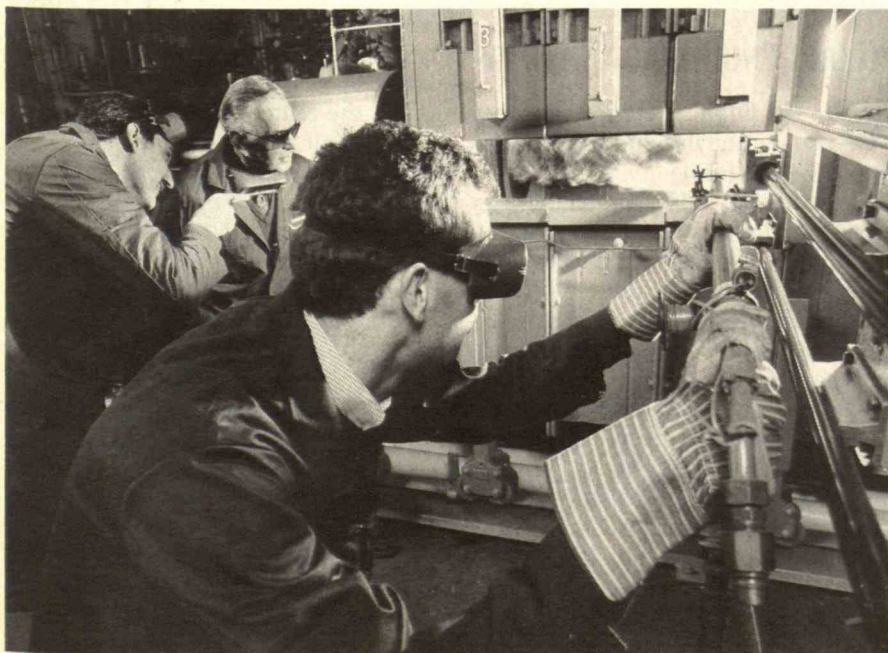
The problem with burning coal is that it usually emits oxides of nitrogen (NOx) and sulfur (SOx). Both are precursors of acid rain, and NOx is the chief villain in smog. In contrast, natural gas contains little nitrogen or sulfur, and it produces 60 percent less of the

greenhouse gas carbon dioxide.

New estimates that give the United States a 50-year supply of natural gas, compared with prior estimates of a 20- to 30-year supply, make the fuel an obvious candidate to replace coal for generating electric power. But Beér, who heads MIT's combustion research facilities, doesn't think out-and-out substitution is necessary. Some relatively clean-burning techniques that combine gas with coal can be used to create low-pollution electric generating systems, he says. In the most technically sophisticated of these systems, the efficiency of energy conversion promises to be significantly higher than in any of today's power plants.

The simplest system, according to Béer is not more efficient but it does reduce pollution. A small amount of natural gas is injected into the combustion chamber of a coal-fired boiler to mix with the hot combustion products of coal. This causes chemical reactions

Chemical engineer Janos M. Béer (center) and his colleagues Majed A. Toqan (left) and Johannes H. Thijssen check nitrogen oxide emissions in MIT's experimental combustion chamber.



that turn 50 to 75 percent of the NO_x the coal produces into nitrogen, a non-polluting natural constituent of air. Converting the furnace is inexpensive, and the cost of removing the NO_x is less than 10 percent that of implementing the catalytic process that the U.S. Environmental Protection Agency is considering for NO_x control. Conventional scrubbers are used to control SO_x pollution. In this system, the coal provides 80 percent of the total energy and the natural gas the rest.

Two other approaches could better capitalize on natural gas in power generation, says Béer. Both are based on linking a gas-powered turbine with conventional coal combustion.

In the simpler of these systems, the gas turbine is used to produce electrical power. Coal is then burned in the oxygen-rich exhaust, and the steam that results is expanded in a conventional steam turbine to make more electricity. This system's efficiency is well over 40 percent, up from the 35 percent typical of modern coal-fired generating plants. Although the usual methods for controlling SO_x and NO_x from coal are needed, the additional power comes with no extra pollutants. "Anyone look-



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MIT REPORTER

ing at environmental issues has to focus on efficiency," says Beér.

Beér is particularly interested in the second of the two systems—the "air-heater topping cycle," which he has helped develop. He has also modeled it at MIT. In this system, a coal furnace generates steam to turn a conventional steam turbine. The furnace preheats air for a gas turbine as well, and burning this air with natural gas raises the temperature at the inlet of the gas turbine. This sharply increases the system's efficiency, which can top 50 percent, with half the energy coming from coal and half from gas.

The technique yields little pollution per unit of power. "Cool-combustion" strategies developed by Beér allow the gas turbine to give off much less NOx. While the coal combustion still results in NOx and SOx, it also enables the system to produce a good deal more power than would have been possible with approaches that use either coal or gas alone. The level of emissions remains the same as it would have been if production had not increased.

After tests by Westinghouse Electric, the U.S. Department of Energy is promoting development of the air-heater topping cycle.—By JOHN I. MATTILL, editor emeritus of Technology Review ■

MIXING ENGINEERS AND BUGS



In the public eye, biotechnology usually equals biology. But it also involves engineering.

Consider an MIT biotechnology project headed jointly by biology professor Anthony Sinskey and chemical engineering professor Gregory Stephanopoulos. The aim is to maximize the manufacture of amino acids and enzymes using a bug called *Corynebacterium*. The Stephanopoulos team has used computer modeling to find bottlenecks in the bacterium's production of amino acids. Sinskey has developed genetic tools to overcome those problems. Next, Stephanopoulos and others will figure out appropriate purification techniques.

Recognition that biotech combines

science and engineering led to the creation of MIT's Biotechnology Process Engineering Center (BPEC). Through this center, which is funded by the National Science Foundation, both students and working engineers learn about biotechnology from biologists, chemists, and engineers. The center also encourages members to work with industry: representatives from about 100 companies visit the center annually.

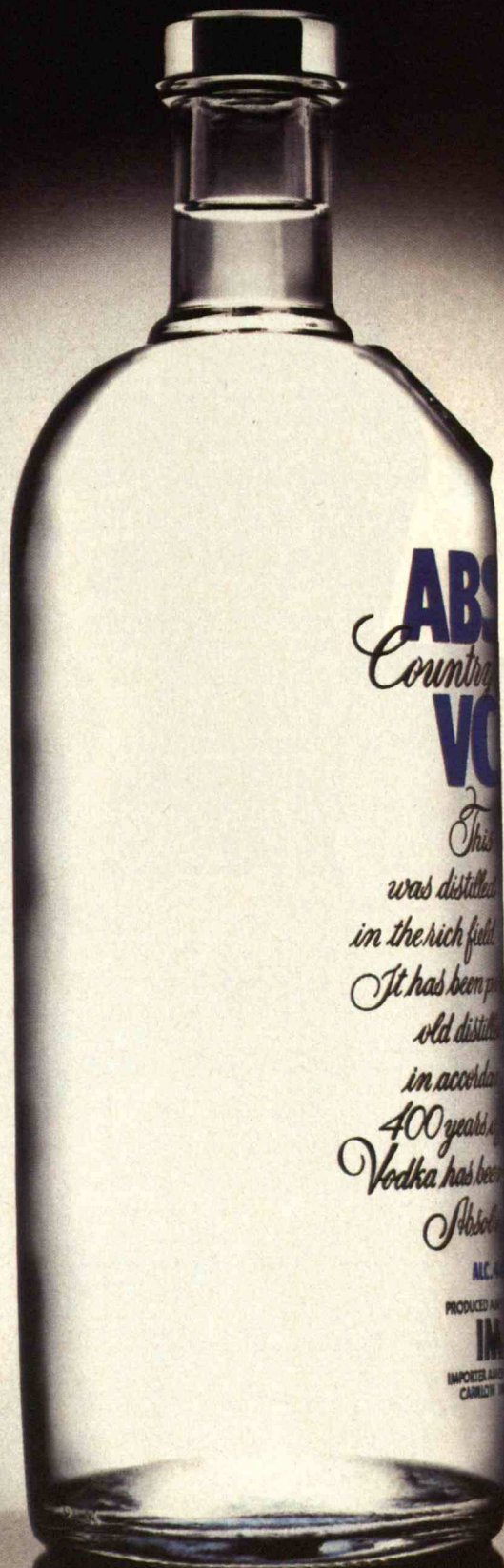
The concept is unusual, according to Noubar Afeyan, a BPEC graduate and founder of PerSeptive Biosystems, a biotechnology company based in Cambridge, Mass. Many universities have biotechnology programs within their biology or chemical engineering departments, but bringing together academics from several disciplines as well as people from industry is a relatively unexplored approach.

Former student John Aumins reports that BPEC gave him the advantage of a real-world perspective early on. "Most chemical engineers, even those from very good departments, don't have the global overview that comes from that interactive environment," says Aumins, now a Merck chemical engineer.

Afeyan recalls that while he was finishing his PhD at MIT, BPEC gave him access to companies that could provide feedback on the potential of one of his projects. Now he values the center because it allows him to talk with many kinds of academic scientists. "I can't praise the center enough," he says.

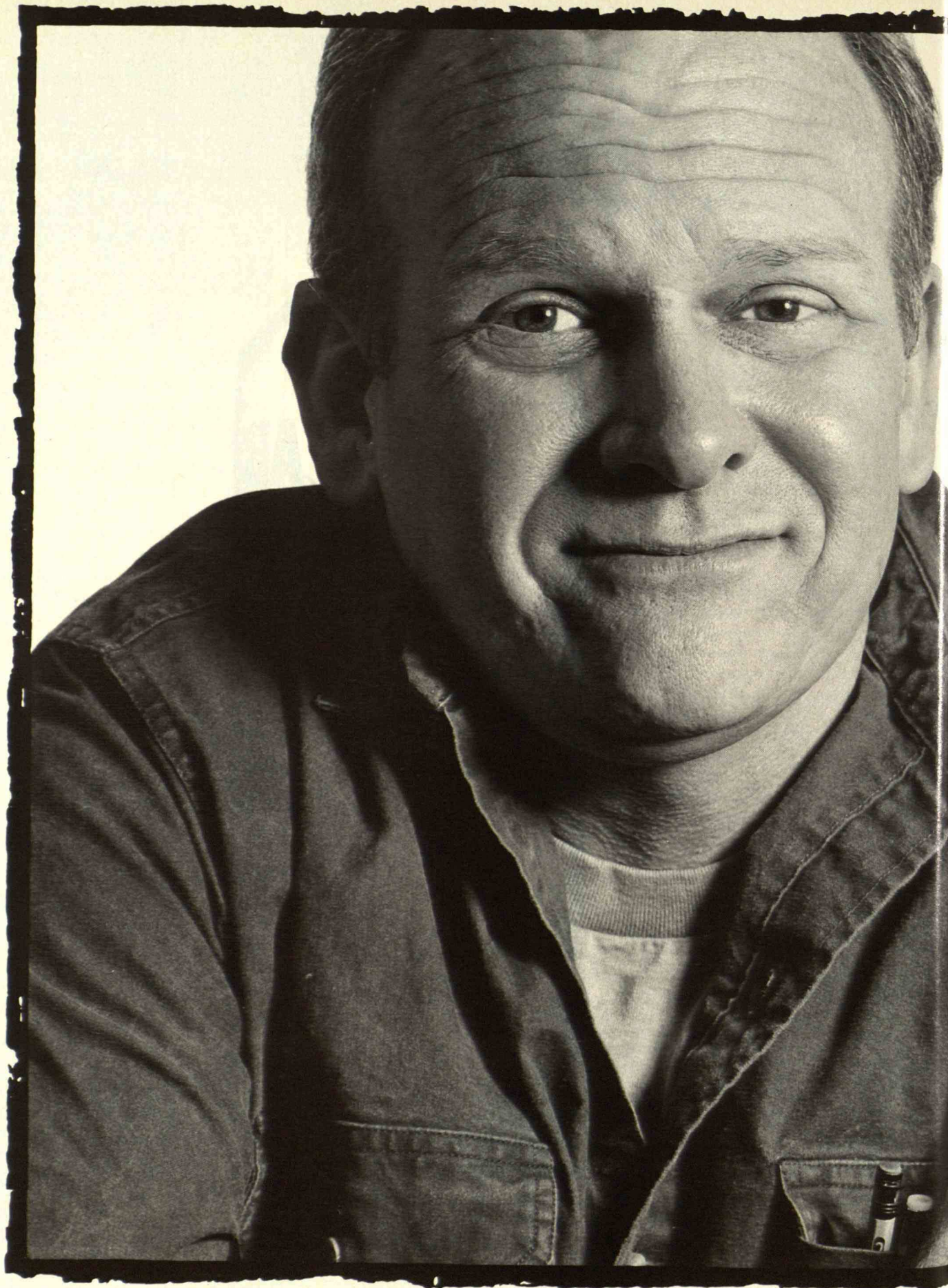
But some outsiders find fault with BPEC. Postdoctoral biologist Maximilian Follettie says the center gets "twice the criticism" because of its relationship with both academia and the corporate world: "Academics think we're too close to industry, and the industry guys think we've got our heads in the clouds."

"There's always tension of this sort between pure and applied science," notes George Whitesides, a BPEC principal investigator and Harvard University chemist. But he says he is sure about BPEC's worth. "We need to produce people who know enough biology and engineering to judge which approach to take."—By SUSANNAH HAGADORN, a chemist and free-lance writer ■



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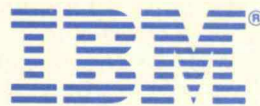
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Trends

To Catch a Cloud

For residents of coastal deserts, no sight is more tantalizing than the daily procession of low-flying clouds that promise rain without delivering. It's even more frustrating when mountains, even small ones, are nearby, for the clouds can bump into the hills and deposit their life-giving moisture as fog or drizzle. That may sustain trees and shrubs, but it yields little water for drinking or farming.

Now a joint Canadian-Chilean project has shown that clouds can be trapped and milked of their precious moisture. In the hills 2,500 feet above the small and arid fishing village of Chungungo, about 300 miles north of

Santiago, researchers have set up 50 nylon mesh nets to collect moisture. Each is 39 feet long and 13 feet wide.

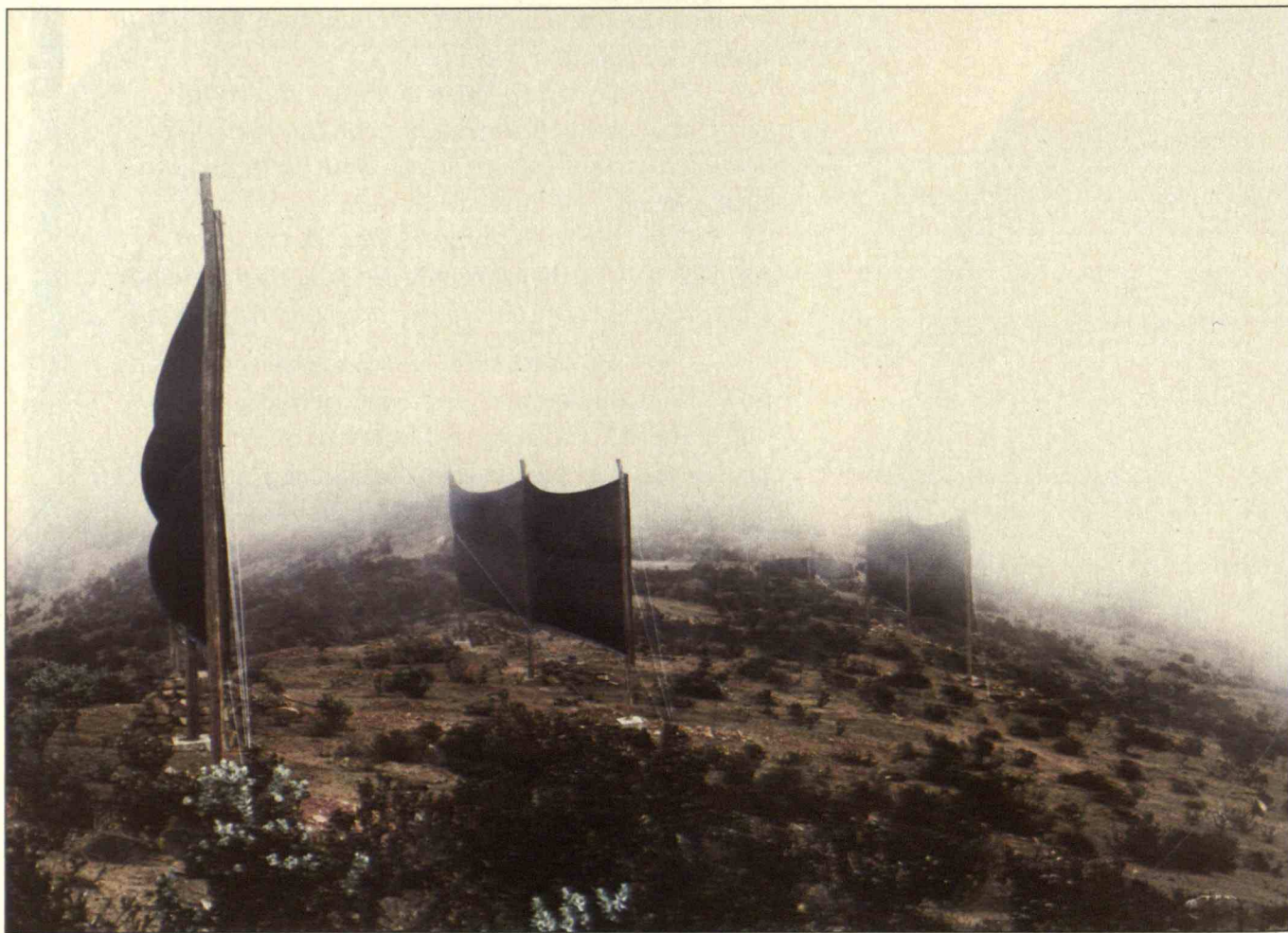
When the wind-blown fogs called *camanchacas* stream through the mesh, it strains out droplets about a tenth the width of a human hair. The drops drip down and leave behind an average of 2,500 gallons of potable water daily. For those worried about potential ecological changes, Robert Schemenauer, a cloud physicist with Environment Canada in Toronto, points out that the cloud-catching process removes only about a tenth of a percent of the water in the clouds in the area.

Unlike cloud seeding, which works only with thick cumulus clouds on the

verge of naturally producing rain, the catching technology can be applied to any kind of cloud, says Schemenauer, who has worked on the project along with Chilean geographers Pilar Cereceda of the Pontificia Universidad Católica and Nazareno Carvajal of the University of Chile. The researchers chose the arid fishing village because it had been the site of small-scale experiments in cloud catching and afforded good access and security.

Traditional cloud seeding has been

Nylon nets on a hill near the Chilean coast provide water for the village of Chungungo. Until recently, Chungungo depended on water trucked in 40 miles.



dogged by scientific doubts over whether it really increases rainfall significantly, but with cloud catching, says Schemenauer, "You can see . . . that you actually collected water where you didn't have it before." Supported by a grant from Canada's International Development Research Center, the project has moved on to its next step—a roughly four-mile pipeline that brings the water to town.

Schemenauer and his colleagues think that the cost of the water over a 20-year period will average \$2 a cubic meter, including construction and delivery expenses. That's about what Chungungo's 350 inhabitants now pay for water trucked in from a small river 40 miles away. The municipal government subsidizes the trucked-in water heavily, though: otherwise, it would cost \$8 a cubic meter.

The cloud-lassoed water should double the four-gallon daily ration that Chungungo townspeople now exist on. That's about a tenth the amount the average person in the United States uses. Equally important, Chungungo never lacks fog-creating clouds for more than nine days, even in the Southern Hemisphere's dry summer.

Cloud catching may also provide an avenue to foster another vital Third World project—reforestation. In Chile, a federal forestry project has started an experimental seven-acre tree farm near the cloud-catching site, in an area where iron miners planted a small eucalyptus stand about 50 years ago. Once the trees reached a height of about six feet, the *camanchaca* naturally deposited enough moisture on them to sustain growth without irrigation.

A Drink of Desert Gold

Previous experiments near San Francisco and in Tasmania and Hawaii and have demonstrated that the principle of cloud milking is technically sound. However, in the developed



Robert Schemenauer thinks the cloud-catching technology he helped install in Chile could supply water at sites in some two dozen other states and countries.

world, "it is an awful lot easier to divert a river than put up a whole bunch of collectors," Schemenauer notes. Diversion and dam technology are widely accepted, and "you would need a very large collection array to approach the water available in rivers and lakes."

Thus, he believes, cloud catching will catch hold "in those areas where they have no option." In a paper soon to be published in the Swedish journal *Ambio*, Schemenauer and his colleagues describe *camanchacas* in some two dozen states and countries—from California and Honduras to Yugoslavia, the Canary Islands, and Kenya.

Several hundred sites in the northern deserts of Chile and still more in Peru would be suitable for nylon nets. Economic development there has been

hamstrung by an arid climate that makes habitation next to impossible. For two years, Schemenauer and his associates have been looking at a site 25 miles south of Lima—"an incredibly dry part of the world, getting an average of 10 millimeters a year of precipitation."

Still, cloud catching may be uneconomical even where water costs are high. Encouraged by the Chile project, the Sultanate of Oman has been funding a study to determine whether cloud catchers can milk a two-month *camanchaca* that occurs each year in the mountains near the town of Salalah. The clouds yield both fog and drizzle, and preliminary estimates have suggested that because of their thickness and the prevailing wind conditions, the location could produce as much water in two months as the Chungungo site does in twelve.

Omani officials were hoping that cloud catching would prove cheaper than local water costs—now between \$6 and \$12 a cubic meter. "However, results are slightly discouraging," says Robert Whitcombe, an environmental planner working for the Omani government. While technologically feasible, cloud catching in Oman may cost more than desalinization and water pumped from boreholes. The fog season there is too limited, and at most locations the cost of fabricating, erecting, and maintaining collecting screens is too high for this short season.

"If you have no alternative, cloud catching is a good source of water. But if you are going to be spending thousands of dollars, then you may have other options," Whitcombe concludes. Even so, he notes, the study has shown the value of preserving Oman's mountain forests, which channel water from *camanchacas* into underground aquifers. ■

—STEPHEN STRAUSS, a contributing writer to *Technology Review* and a science writer at the *Toronto Globe and Mail*

Global Smoke Out

Two decades ago, the U.S. government launched a highly publicized "war" on cancer. An ambitious failure, it sought a swift cure for the disease by pumping federal funds into biomedical research.

Today, a new war on cancer is under way. This time it is global, and the focus has moved from laboratories to corporate boardrooms and international-trade forums to target cancer's best-known culprit: tobacco.

Last spring, in Australia, a thousand tobacco opponents heard New Zealand minister of health and labor Helen Clark summarize their strategy. The battle, she said, "is no longer purely a scientific one. It is not one which can be won by miracle cures. It is not one which can be won by medical technology or by massive public education campaigns alone. It is one which can only be won now in the political arena."

Clark's exhortation stands against a backdrop of mounting deaths from tobacco—"the twentieth century's brown plague," says a recent American Cancer Society report. If current trends continue, the worldwide death toll from smoking-related diseases will rise to 12 million people annually by the year 2050. The American Medical Association estimates that the diseases will kill 200 million people now under the age of 20.

Health costs from smoking-related disease are estimated at over \$50 billion a year in the United States alone, but the vast majority of cases occur in underdeveloped countries, many of which have been targeted by U.S. tobacco makers. And as smoking declines in the United States, Canada, and Western Europe, tobacco companies are expanding their markets elsewhere. Owing primarily to increased consumption in Asia, global tobacco use jumped 75 percent in the '70s and '80s and continues rising. In China, cigarette consumption has increased fivefold since 1965, the U.S.



Smoking opponents don't want U.S. firms to use exports to compensate for a declining domestic tobacco market.

Department of Agriculture estimates.

Tobacco firms have been aggressive and savvy in holding overseas markets and capturing new ones, and Washington has usually aided these efforts. When Taiwan, Korea, and Japan sought to restrict U.S. cigarette imports, the Reagan administration threatened severe sanctions on their exports to the United States. The United States also convinced General Agreement on Tariffs and Trade (GATT) officials that restrictions would unfairly limit trade.

Yet as early as 1975, a World Health Organization (WHO) committee asserted that controlling the spread of smoking would "do more to improve health and prolong life than any other single action in the whole field of preventive medicine." As a result, anti-tobacco activists are stepping up efforts to match the industry's reach and sophistication. The self-titled "tobacco-control community" has won the world's strongest warning labels in Sweden and partial or total advertising bans in New Zealand, Thailand, Singapore, and Europe. Australia is well on the way to stricter measures as well, with state regulations in effect and federal regulation pending.

The most significant recent showdown took place last year when Thailand sought to protect its own tobacco industry. The result was internationally sanctioned tobacco-control measures.



"Our biggest fear was that the United States would roll right through like they had in disputes with Taiwan and Japan," notes John Bloom, who manages international issues for the Advocacy Institute, a smoking-control resource center in Washington, D.C. But when the United States announced its intention to enact sanctions against Thailand, a computer network called Globalink helped health advocates mobilize. The resulting flood of letters "at a crucial time . . . served to remind the United States that the international tobacco-control community is united."

While the GATT board ultimately told Thailand to open its markets to U.S. cigarettes, Bloom calls the decision a success since it specifies "that much of the tobacco issue falls into the health exception of GATT rules." Gregory Connolly, who directs the Massachusetts Office of Smoking and Health and testified before the GATT board in the case, agrees. "The bottom line is that [the ruling] will restrict tobacco consumption and lives will be saved," he says. "For the first time, we saw a major international trade body promoting tobacco control."

Connolly thinks the case marks a turning point for tobacco opponents. After years of targeting smokers with "half-baked smoking cessation guides," health advocates had been "knocked flat by the powerful ad and promotion campaigns run by the tobacco industry." Now, he says, anti-



tobacco forces "understand that we're dealing with an economic problem" requiring economic measures.

Connolly and Bloom point to Canada to prove the efficacy of economic disincentives. Canadian officials, they say, have decided that the health care system can't afford the cost of tobacco-related diseases. The government has enacted perhaps the world's strongest anti-smoking regime, doing everything short of establishing an outright ban to discourage smoking.

First, Canada imposes a tax of roughly three dollars on each pack of cigarettes. It also severely restricts tobacco advertising; even promotional events and other gimmicks will be illegal by 1993. It prohibits smoking in public spaces or workplaces under federal jurisdiction—amounting to 9 percent of all workplaces. Direct warning labels—stronger and more prominent than those on packs of cigarettes in the United States—caution consumers that smoking is the major cause of lung and heart disease.

Since 1980, when Canada first introduced anti-smoking measures, the number of smokers has dropped by a third. Just since the latest round of taxes in April 1989, the number of smokers has declined almost 10 percent. Tobacco-control advocates hope that Canada will be a harbinger of things to come. ■

—SETH SHULMAN, a contributing writer to Technology Review

A Growing Solar Family

For the next several years, the Palomar Observatory Schmidt telescope in California will be the site of a project to uncover new objects in the distant reaches of our solar system. Led by planetary scientist Eleanor Helin of the Jet Propulsion Laboratory in Pasadena, Calif., the Deep Solar System Survey will search for distant space objects.

"We continue to find new satellites and other objects in the outer solar system—and many of these objects have been found very recently," says Helin. "Suddenly you begin to realize there is nothing special about having nine planets."

Thanks in part to images Voyager 2 took in the vicinity of Neptune, researchers now have evidence of asteroid-sized objects in the outer solar system. "There is a very good chance that there are many other objects in the outer solar system—whether you call them planets, planetoids, planetesimals, or distant comets," says Helin. "With the capriciousness of chance and luck, I think that we'll find objects out there."

Helin will be combining the survey deep into the solar system with her work as head of the Palomar Planet-Crossing Asteroid Survey, which is looking for objects whose orbits come close to the inner planets. For that search, team members take pairs of photos at Palomar. Each six-minute exposure in a pair is separated by 30 to 45 minutes so that moving objects leave a displaced image. When viewed through the special optics of a stereoscopic microscope, this image appears three-dimensional.

"Such an effect catches your attention," says Helin. "And as you blink from eye to eye, you can see the image move from one place to the other on the two films." The movement can be small, as with an asteroid in the main belt between Mars and Jupiter. Or it can be considerable. With the newly

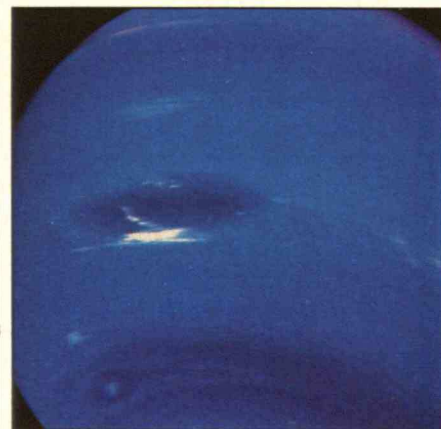
discovered, fast-moving asteroid 1991AQ near the earth, "the displacement was so significant that it left a trailed image" on the film.

The difference between searching for near and deep solar system objects lies in the time lapse needed between photographs to reveal motion. For asteroids near the earth, it's enough to space the exposures around 35 minutes apart. "But for the more distant solar system objects," says Helin, "you have to take exposures separated by a day or longer to see evidence of the movement."

Looking at photo pairs separated by one day, researchers should be able to find objects just beyond Neptune's and Pluto's orbits. For objects farther out, it will be necessary to separate the photos by two days.

Astronomers elsewhere will cooperate in the search but not formally under the survey. The main purpose of these additional observations will be to confirm the existence of new bodies. And while the deep solar system survey is concentrating on the Northern Hemisphere for now, a complementary program in the Southern Hemisphere will begin soon. Finally, besides searching along the plane of the earth's orbit, where most solar system bodies reside, the project

Voyager 2's observations near Neptune provide evidence of asteroid-sized bodies in the outer solar system.





will seek out objects in more eccentric orbits.

Searching for X

The Deep Solar System Survey seems simple, yet, says Helin, "We probably couldn't have done this type of study effectively until now." Researchers can analyze slightly out-of-focus images for fast-moving objects such as near-earth asteroids, but with more distant and fainter objects, sharp focus is almost mandatory. "We feel that our techniques have improved and that our films are now of sufficient quality to work at detecting more distant solar system objects."

On clear nights for one week a month at the Palomar telescope, Helin and her colleagues will look for both the obvious objects and ones that are hypothetical. A special part of the project will seek to discover if a tenth planet in our solar system really exists—the so-called Planet X.

Based on Percival Lowell's calculations of irregular movements in the orbit of Neptune, Clyde Tombaugh found Pluto in 1930. But lately astronomers have lowered their estimates of Pluto's size, making it less likely that the tiny planet can account for Neptune's movements.

"I shy away from Planet X, but I do think that as measurements of Pluto's mass continue to decrease as we take additional observations, Pluto could not be responsible for irregularities in Neptune's orbit," says

Planetary scientist Eleanor Helin leads a project that could discover objects at the distant ends of the solar system.

Helin. "Observations do seem to suggest that there is other mass out there."

In the future, the deep solar system survey may benefit from several technological advances. For example, the project may have some help from an automated system to review the paired images. Also in the wings is a large array of sophisticated electronic detectors set up on a Schmidt telescope that will be able to pick up far fainter objects.

Provided that astronauts can replace the wide-field camera on the Hubble Space Telescope (tentatively scheduled for 1993), a project to exchange information will get under way. For example, if Helin's group finds an object, the Space Telescope Science Institute will decide whether it merits a look with the Hubble. Conversely, if the Hubble picks up a questionable pinpoint of light, Helin's group will augment information on that find.

"If we painstakingly review our films, we have a very good chance of discovery," Helin points out. "There are distant, undiscovered objects in the outer regions of our solar system. And I feel confident that we will find something." ■

—PATRICIA BARNES-SVARNEY, a free-lance science writer in Endwell, N.Y.

The Educated Workplace

Today's high-tech factories require a different breed of worker than yesterday's assembly line. Manufacturing workers must handle complex computerized machinery, follow frequently modified assignments, and constantly monitor the performance of their equipment.

"Engineers used to be able to 'dummy-down' machinery," according to Jim Frasier, a training specialist at Motorola University, the company's education center in Illinois. "A worker could be trained to do a few tasks and be required to do one task over and over again. We can't do that anymore."

Changing workplace technology has coincided with the decay of schools. Never required to produce many highly literate industrial workers, schools have fallen on particularly hard times. "Our factories in the '80s were a reflection of our school system," says Frasier. He cites Motorola engineers from the early '80s who complained that assembly-line workers couldn't follow instructions on new equipment or keep high-tech machines in tune.

Illinois-based Motorola Corp. is one of a number of firms trying to remedy that situation by offering a familiar curriculum—reading, 'riting, and 'rithmetic. And to look into what technology can contribute to training, the company is joining others in copying what well-financed schools do—experimenting with video equipment, computers, and satellite communications. Thus, under Frasier's direction, Motorola originated Project SALSA—Southwest Advanced Learning Systems Applications—a six-month research project in computer-assisted adult education.

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Motorola workers of various ages and cultural backgrounds, all of whom scored between the third- and sixth-grade levels on English and math tests. The participants were already enrolled in remedial courses jointly offered by Motorola and Phoenix's Rio Salado Community College.

For the duration of the project, which ended in December, the employees continued to attend Rio Salado, but 53 of them received home computers linked to NOVAnet, an electronic education network based at the University of Illinois. Project SALSA used the technology "to help motivate our employees to do some learning in their own homes, to back up actual classroom instruction," explains Jeff Gorin of Motorola's Phoenix office.

"What I tried to do is bring existing technology—technology already used in the classroom and the learning laboratory—into the home," says Frasier. "I said, 'Let's see what happens if people don't have to go into the lab.'"

Smart Machines, Smart People

Through NOVAnet, the 53 Motorola employees, as well as their families, could draw on 10,000 hours of computer-based instruction developed at the university. University of Illinois curriculum specialist Dorothy Silver notes that "you could have more access to interactive learning by having it available to the user 24 hours." The courses ranged from third-grade grammar and math through postgraduate offerings. Besides reading, math, and spelling, says Silver, the instruction included material in such subjects as government, foreign language, economics, U.S. history, and algebra.

Motorola hopes to find that the workers who had home computers acquired reading and math skills faster than those who only attended classes. Did 24-hour access to course material and educators—through NOVAnet's



A Motorola education experiment for workers also benefited their families.

electronic mail, bulletin boards, and other communications systems—facilitate learning?

A team at Rio Salado Community College is analyzing the results of Project SALSA, but anecdotal indications of success are in now. According to Frasier, no participants griped or dropped out of the pilot project, and several delayed returning the computers after it ended. Also, families found creative ways to take advantage of NOVAnet course offerings—a Navajo woman taught her 9-year-old daughter their native tongue, while a 10-year-old boy studied three European languages.

Catherine Foster of the University of Illinois suggests that computer-based studies have another advantage for adult education. "Many people are embarrassed by not being able to read," she observes. "If they can admit that to a computer and work with a computer, they might be able to learn more quickly than if they simply have to face a teacher."

Project SALSA required only a tiny investment—Apple loaned computers, the University of Illinois do-

nated access to NOVAnet, and Southwestern Bell pitched in free phone lines. Excluding the hardware, these services would have cost just a little over \$7,000. However, educating workers on a wide scale is costly. Motorola requires all its 100,000 employees to take 40 hours of training or education classes every year. It employs 150 trainers and educators at its nine-year-old Phoenix training center and over 2,000 worldwide.

"To be competitive in our global environment, we have to be continually training our people," Gorin notes. Or, as the late social critic Michael Harrington once wrote, "Management has been forced to reskill at least some of its employees, learning that 'smart machines' work much better if they are run by smart people."

Still, that realization is barely getting through. As of 1988, U.S. companies were spending \$30 billion annually to educate their employees, 30 percent of which went to computer-based systems. That's a fraction of the over \$150 billion the nation invests in public primary and secondary education. ■

—JAMES GOODNO, a staff editor of *Dollars & Sense* magazine



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The Metal That Remembers

Imagine sitting on your eyeglasses, bending the frames in half. Rather than returning to the optometrist, you dip the crumpled wreck in hot water. Instantly, it snaps back to its original shape. This isn't fantasy if the frames are made of nitinol, a metal with "shape memory."

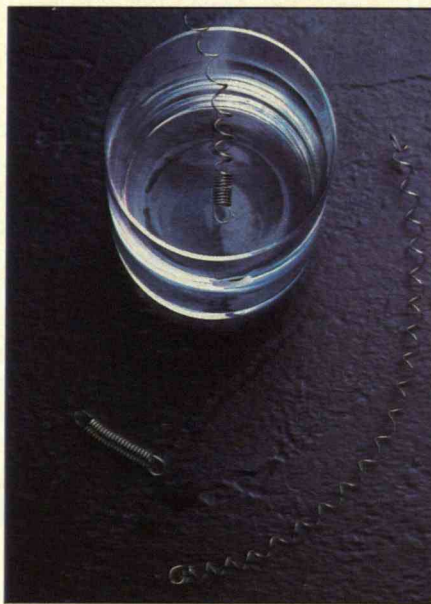
Furthermore, the shape memory can be set to activate anywhere between -148 to 212°F , which makes it useful in movie posters, underwire bras, surgical tools, anti-scalding shower heads, and more. In fact, the newest eyeglass frames return to shape at room temperature, eliminating the need for hot water.

Researchers at the Naval Ordnance Laboratory (now the Naval Surface Warfare Center) discovered nitinol by accident in 1962. They were looking for a way to make titanium less brittle. They tried adding nickel, and when they were showing a wire to administrators, recalls co-discoverer Frederick Wang, "one guy was smoking a cigar. When he held his match too close, it snapped."

One of the first results of this discovery was a new way to link hydraulic lines on the Navy's F-14 fighter jets. A nitinol sleeve is cooled with liquid nitrogen, which enlarges it. Next it's slipped into place between two pipes. When the sleeve warms up, it contracts, clamping the pipes together—and keeping them clamped with a force of about 50,000 pounds per square inch.

While never classified, nitinol was slow to make its way into the commercial marketplace because it's tricky to work with. The temperature that triggers its shape change, determined by the concentrations of nickel and titanium, is difficult to set—a 1 percent difference in either material can alter the memory temperature by 248°F .

Nitinol has other manufacturing



A twisted nitinol spring can regain its original form just by being dunked in a glass of water.

quirks, too, like hardening into the stuff of nightmares during drilling or lathing—drilling brass is like butter in comparison. Welding and electroplating have also been extremely difficult until very recently.

And then there's the difficulty of getting the wire to a desired shape. "Ordinarily we would just run it through a die to reduce the diameter of stock wire," explains David Chute, vice-president of Marchon Eyewear. "But when we do that with nitinol, friction heats it up, its memory activates, and it pops out the other end the same size."

"The metal is also elastic enough that if you put it in a high-ton press and don't use enough force, it will just spring out of the die unchanged," Chute adds. "But if you press with too much force, the metal explodes, leaving you with shredded wheat."

Marchon finally solved the manufacturing problems in 1986, partly by using oil to reduce friction. The company now also changes the wire's diameter in easy stages. To get nitinol into a mold, a moderate amount of force is applied several times.

Toys, Teeth, and Tools

With technical difficulties more or less hammered out, manufacturers of ni-

tinol consider it a metal with a mission. "We are currently selling over 20 different products and working with companies in as many different types of industries as you can imagine—medical, transportation, consumer products, you name it," says Darel Hodgson, president of Shape Memory Applications.

"We are more limited by engineers' visions of how to use nitinol than by properties of the material itself," he thinks. "It has been looked at for everything from tamper-proof medicine bottles to satellites."

On the novelty side, nitinol toys include blinking movie posters, wing-flapping florist's butterflies, and tiny tail-swishing dinosaurs—applications driven by a contracting bit of wire connected to a watch battery. Other toys include the Thermobile and Ice-mobile, which are wheels that hot water or ice cubes set in motion.

In space heaters, nitinol wires outshine conventional bimetal circuit breakers by cutting current off in one-tenth of a second rather than 15 seconds. Orthodontists often use nitinol wires and springs in braces because the elastic metal pulls with a more gentle, even force than stainless steel, causing less pain. This elasticity also makes nitinol an important addition to catheter guide wires.

Because the metal doesn't react with organic materials, it's suitable for a new type of blood clot filter. Doctors can place a bundle of six straight nitinol wires in a catheter and thread that into an abdominal vein. When released, the bundle snaps into a flower shape, anchors inside the vein, and traps large clots before they reach the lungs and kill the person.

Finally, surgical tools with nitinol handles can be bent up to 90 degrees, which makes replacing heart valves easier. The tools straighten out in the sterilizer so that the next surgeon can use them. ■

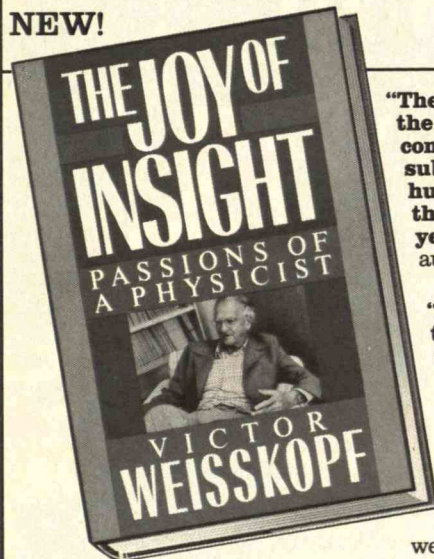
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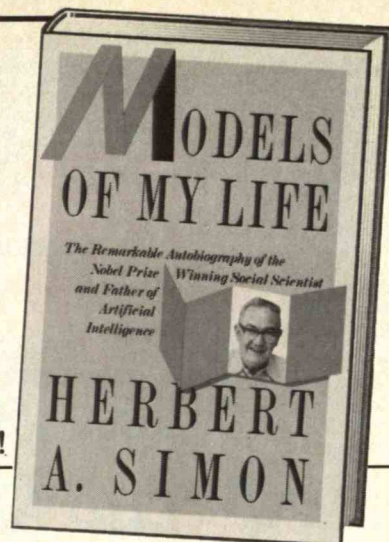
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A foreign policy

modeled on the Persian Gulf conflict raises deep questions

about America's future role in the world.

Behind Desert Storm

The New Military Paradigm

BY MICHAEL T. KLARE



WHATEVER the final outcome of events in the Persian Gulf, Operation Desert Storm has inaugurated a new paradigm for the U.S. military. While prior models for combat assumed that U.S. forces would fight the Warsaw Pact in Europe or guerrillas in Central America, this model envisions periodic battles with well-armed regional powers like Syria or Iraq. To distinguish these clashes from European "high-intensity combat" or a Central American "low-intensity war," Pentagon

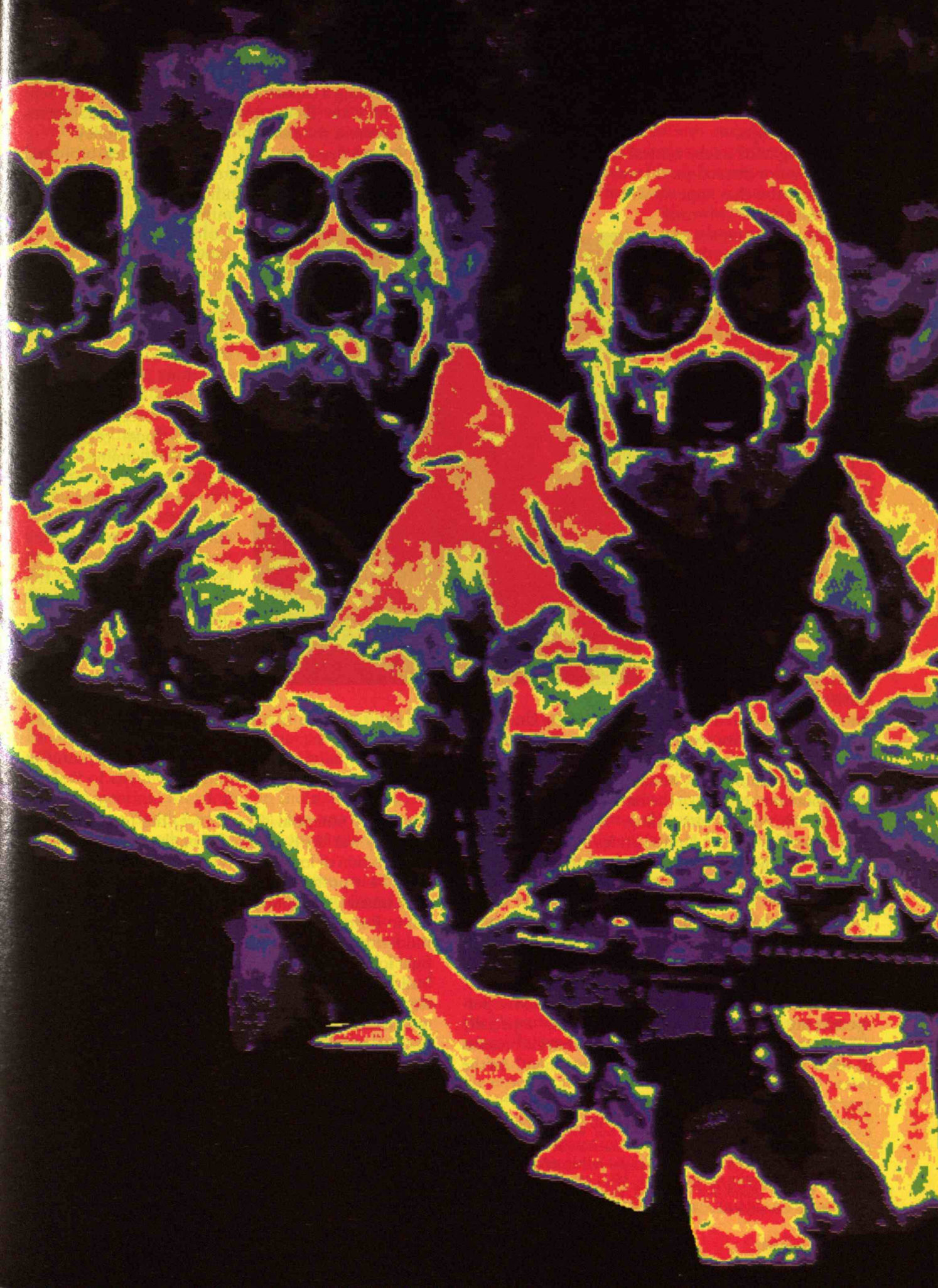
officials categorize them as "mid-intensity conflict" (MIC).

Like Desert Storm, future mid-intensity conflicts are likely to be rapid-paced and high-tech, entailing unrestrained use of the most sophisticated weapons. In essence, the United States will fight rising Third World powers by wielding weapons designed for a war with the Soviet Union.

Although there is no obvious candidate for the "next Iraq," the perceived risk of mid-intensity conflict will likely persist for years. Other Third World nations such as Syria, Pakistan, and Brazil harbor ambitions that could eventually lead to a collision with the United States, and some of these aspiring powers possess large and modern arsenals, including weapons of mass destruction—chemical, nuclear, and biological munitions.

"There was a time when conflict in developing countries conjured up a vision of simple, low-tech warfare that would not require sophisticated weapons," Adm. Carlisle Trost told Congress early in 1990, but "that time has passed." Today, "developing countries are armed with 'First World' weapons. Proliferation of chemical weapons, growing access to nuclear weapons capability, and proliferation of cruise and ballistic missiles, submarines, and high-performance tactical aircraft mean that virtually any nation . . . can bring capable and deadly weapons to bear." This being the case, Trost argued, "the fundamental defense issue for the United States in the foreseeable future is to maintain a military posture that protects our interests and those of our allies from a diversity of regional threats."

A national security posture based on MIC has many obvious attractions for the U.S. military—not least of which is that it provides a rationale for retaining large high-tech forces in the Pentagon lineup. The Warsaw Pact's rapid dissolution leaves little need for such forces in Europe, and the Green Berets and other lightly armed infantry forces can conduct anti-narcotics and counterinsurgency operations in Latin



America. By contrast, the threat posed by emerging Third World powers arouses much anxiety in Congress, so the Defense Department can justify retaining armored and mechanized units like those it is withdrawing from Europe.

Adopting MIC as the central thrust in strategy has another major attraction: it invests the United States with a mission that appears worthy of a superpower. Knocking off Manuel Noriega can't compare as a cause to containing Soviet expansion over 40 years. With the Cold War's end, many U.S. leaders perceived a "mission gap"—the lack of a military mission comparable in scale and importance to the policy of containment. And American leaders clearly crave such a mission: "We have to put a shingle outside our door saying 'Superpower Lives Here,' no matter what the Soviets do, even if they evacuate from Eastern Europe," Gen. Colin Powell of the Joint Chiefs of Staff has suggested.

No one embraces this global mission more enthusiastically than George Bush. When Iraq is vanquished, he declared in his 1991 State of the Union address, we "will have sent an enduring warning to any dictator or despot, present or future, who contemplates outlaw aggression." Yes, he said, America will bear a disproportionate share of the burden of delivering this message. But that is our calling: "Among the nations of the world, only the United States has had both the moral standing and the means to back it up. We are the only nation on earth that could assemble the forces of peace."

So the United States has again found a global mission. And while this new posture comes wrapped in moralistic finery, it carries important geopolitical advantages that U.S. policymakers have not ignored. Many of the regions most significant from an MIC perspective are sources of critical raw materials—especially oil—that unquestionably provide vast strategic benefits to those nations who possess or control them. As the

self-appointed guardian of these critical assets, the United States can assume a dominant role in world affairs. By providing a capacity for military intervention, Sen. John McCain (R-Ariz.) suggested in 1990, U.S. forces "will remain the free world's insurance policy."

Nevertheless, the MIC posture carries profound dangers for the United States. This country will have to maintain a mammoth military establishment, keep

military budgets at peak Cold War levels, and eliminate hope that a significant "peace dividend" can be garnered from the Cold War's end.

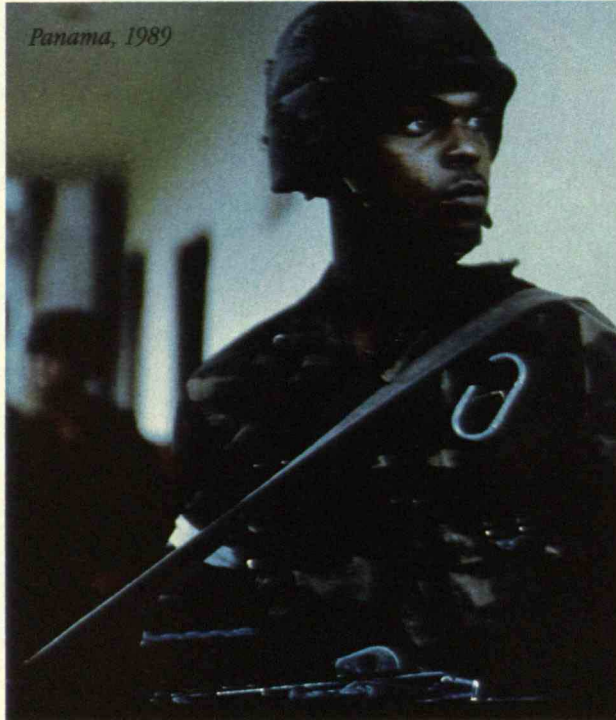
An MIC-dominated strategy also raises deep questions about America's world role. A belief in the efficacy of force to keep belligerent local regimes in check could diminish efforts to implement non-proliferation treaties and other such measures to curb the spread of sophisticated weapons. And although President Bush speaks frequently of a "new world order" based on cooperation, Washington's concomitant desire to serve as the preeminent superpower could result in interventions

that will alienate friends and divide the world community.

The Threat Emerges

For all its potential significance, the focus on mid-intensity warfare is recent. Throughout the 1980s, the proliferation of low-intensity conflict in Central America and a hypothetical high-intensity conflict in Europe dominated U.S. military planning. To prepare for combat in Europe, the nation spent billions of dollars on modernizing U.S. nuclear and non-nuclear forces. To fight low-intensity wars, the Pentagon conducted a huge buildup of "power-projection" forces that could be deployed around the world—aircraft carriers, amphibious assault groups, light infantry units, and special operations forces. Officials either considered mid-sized conflicts insignificant or assumed that their arsenal would suffice for any eventuality.

As the 1980s ended, many military analysts began to worry about the threat posed by emerging Third World powers. Although Pentagon rhetoric continued to stress the Warsaw Pact and guerrilla warfare, it was evident that a war in Europe was the least plausible contingency and that the lightly armed forces intended for



MICHAEL T. KLARE, an associate professor at Hampshire College, directs the Five-College Program in Peace and World Securities. His May/June 1990 article "Who's Arming Who?" warned of the growing global violence deriving from the arms trade. He is the author of *American Arms Supermarket* (University of Texas Press, 1985) and co-editor of *Low-Intensity Warfare* (Pantheon, 1988) and *World Security: Trends and Challenges at Century's End* (St. Martin's, 1991).

low-intensity wars would be cut to ribbons by a heavily armed regional power.

These analysts began to reassess U.S. strategic assumptions and press for a military doctrine for full-scale combat with emerging powers. Essential to their arguments is the view that MIC is not just a Central American military action writ large but a new ballgame. Compare, for instance, Operation Just Cause (the December 1989 invasion of Panama) and Operation Desert Storm. In Panama, the United States faced a glorified police force of perhaps 10,000 troops equipped with zero tanks and missiles and four propeller-driven planes. In response, Washington committed 25,000 infantry troops. In Iraq, the United States faced a battle-tested army of 1 million equipped with some 5,500 tanks, 700 modern planes, and a vast supply of guided missiles. To overpower this force, Washington deployed 500,000 combat troops backed by some 1,800 aircraft and 150 warships.

The clear distinction between the encounters reflects a growing differentiation between smaller and poorer Third World countries like Panama and a dozen or so regional powers that have acquired modern arsenals and the ability to produce nuclear or chemical munitions. That select group includes Argentina, Brazil, Egypt, India, Iran, Iraq, Israel, Pakistan, South Africa, Syria, Taiwan, Turkey, and the two Koreas. Such nations stand out as military leviathans in the Third World.

So long as the Soviet Union was seen as the overwhelming threat to U.S. security, policymakers largely ignored this potential threat. Indeed, to secure allies against the Soviet bloc, U.S. officials established formal or informal alliances with many of these countries—often providing them modern arms and war-making technology. And while the bulk of aid went to close allies like Israel and South Korea, Washington provided sophisticated scientific and technical gear to Iraq and other Soviet allies in the hope of diminishing their dependence on Moscow.

"In the years ahead, many lesser powers will have sizable arsenals," observed the influential Commission on Integrated Long-Term Strategy, a high-level study group formed by the Department of Defense and the National Security Council in 1988. Growing supplies of chemical weapons, ballistic missiles, and nuclear arms in the

arsenals of these lesser powers, the commission warned, "will make it much riskier and more difficult for the superpowers to intervene in regional wars." As a result, "the U.S. ability to support its allies around the world will increasingly be called into question."

Because any impediment to intervening in the Third World was anathema to Henry Kissinger and the other former security officials who participated in this study,

the commission called for significantly expanding America's capacity to conduct intensive, high-tech wars in non-NATO areas. "We must diversify and strengthen our ability to bring discriminating, non-nuclear force to bear where needed in time to defeat aggression," the commission argued.

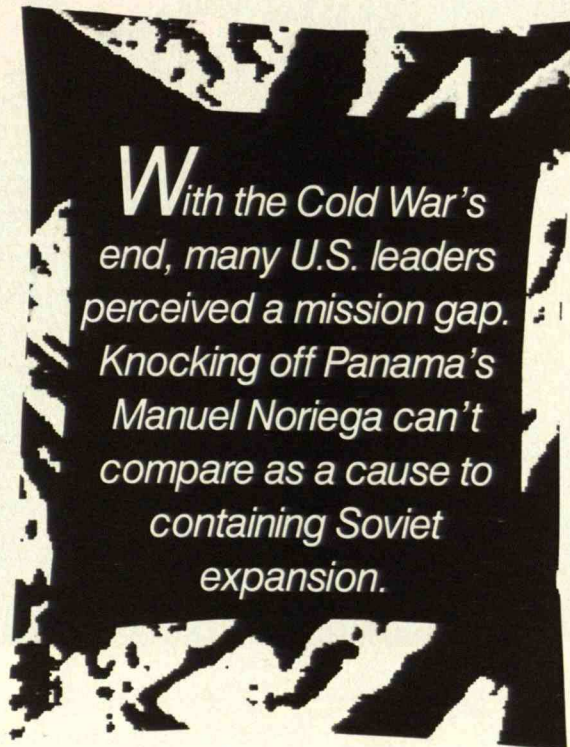
This perspective seems to have had a decisive influence on the strategic outlook of the new administration. Speaking at the Coast Guard Academy in May 1989, Bush introduced the theme in his first major address on national security. "The security challenges we face today do not come from the East alone. The emergence of regional powers is

rapidly changing the strategic landscape." In response, we must both intensify efforts to curb the spread of advanced weapons, and, if necessary, "we must check the aggressive ambitions of renegade regimes."

The notion of well-armed renegades became a major theme in administration rhetoric especially after the collapse of communist regimes in Eastern Europe. Bush continued to stress the Soviet threat through 1989, but early in 1990, with the Warsaw Pact in disarray and the Soviet economy in shambles, he came to portray adversaries like Iraq and Syria as the preeminent threats to U.S. security.

Thus, the perception that mid-intensity engagements would dominate the current era was widespread among military leaders even before Iraq invaded Kuwait, and the Department of Defense had already begun reshaping its forces for the MIC mission. In January 1990, in his first annual report to Congress, Secretary of Defense Dick Cheney warned that the United States must "recognize the challenges beyond Europe that may place significant demands on our defense capabilities." The United States must adopt strategies "that rely more heavily on mobile, highly ready, well-equipped forces and solid power-projection capabilities."

In the ensuing months, Cheney and his associates be-





gan converting this precept into formal policy. In February, he approved a top-secret Defense Policy Guidance statement for the years 1992–97 that orders the services to deemphasize the Soviet threat and prepare for clashes with Third World powers. Details remain secret, but reporters briefed on the document indicate that it calls for reducing U.S. forces in Europe and simultaneously creating a multi-division strike force based in the United States. This force would be intended for rapid deployment to Third World trouble spots—the sort of force that was rushed to the gulf after the invasion of Kuwait.

The chiefs of staff of the Army and Air Force, the chief of naval operations, and the commandant of the Marine Corps issued similar guidance to their cadres. Thence, in statements, documents, and position papers, senior military leaders hammered out a strategy for U.S. military forces in the 1990s—a doctrine built around the concept of mid-intensity conflict. While rough in places, this doctrine was well developed as of August 7, when President Bush ordered U.S. forces to prepare to confront Iraq.

A Post-Vietnam Doctrine

At the heart of MIC doctrine is a belief that protecting vital U.S. interests will inevitably provoke clashes with the emerging powers of the Third World. “Changes in

Europe and the Soviet Union do not promise a tranquil world nor an end to threats to American interests around the globe,” an Air Force “white paper” affirmed in June 1990. Of particular concern are regional powers “working their own agenda” and equipped with modern weapons. This combination of “emerging threats to national security interests [and the] proliferation of sophisticated weapons . . . presents new challenges for U.S. military forces,” the Air Force noted. “*The likelihood that U.S. military forces will be called upon to defend U.S. interests in a lethal environment is high.*” (Emphasis added.)

Army chief of staff Gen. Carl Vuono had given the same outlook two months earlier: “The United States is a global power with vital interests that must be protected throughout an increasingly turbulent world. . . . The proliferation of military power in what is often called the ‘Third World’ presents a troubling picture.” The United States “cannot ignore the expanding military power of these countries,” he said, and thus “the Army must retain the capability to defeat potential threats wherever they occur.” Ultimately, “*this could mean confronting a well-equipped army in the Third World.*” (Emphasis added.)

Running through the documents is the conviction that the United States—and the United States alone—can stop aggressive regional powers. “There will be no substitute for the leadership that the United States has

provided to the West," Vuono affirmed in January 1990. "No other allied or friendly nation has, or is likely to develop, the necessary economic, political, and military power to replace the United States in that role."

This theme was given even more prominence after the outbreak of fighting in the Persian Gulf. "There is absolutely no substitute for decisive, clearheaded American leadership," former Assistant Secretary of Defense Richard Armitage told the *Washington Times* in August. "Those who so recently predicted America's imminent decline must now acknowledge that the United States alone possesses sufficient moral, economic, political, and military horsepower to jump-start and drive international efforts to curb international lawlessness."

The MIC paradigm further holds that the United States should use decisive force when a hostile Third World power provokes it to battle. To prevail in these clashes, the Air Force noted two months before Iraq invaded Kuwait, "U.S. forces must be able to provide a rapid, tailored response with a capability to intervene against a well-equipped foe, hit hard, and terminate quickly."

It is apparent from such statements that MIC is consciously intended to overcome what U.S. military officers see as the mistakes of Vietnam. From their perspective, the principal error was to apply firepower gradually in the belief that the enemy would sue for peace at a low level of escalation, whereas, in fact, North Vietnam took advantage of "gradualism" to build up its own military. The new doctrine calls for the fast, concentrated firepower to destroy an enemy and crush its will to fight.

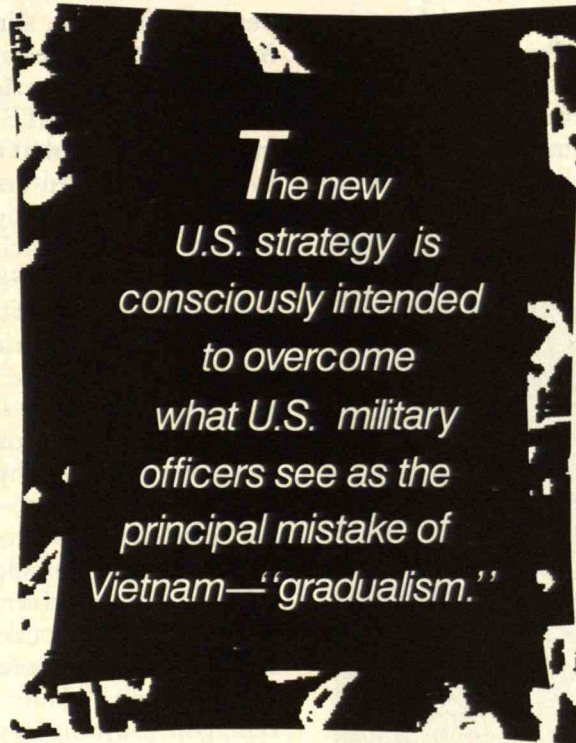
One can, of course, draw other lessons from Vietnam—for instance, lessons about the need for political clarity and cohesion when committing a democracy to a conflict abroad. It would be a mistake, moreover, to view Vietnam as a "limited" conflict, given the years of steady bombing by B-52s and other aircraft of North Vietnam, Laos, and Viet Cong positions in the South. Still, the aversion to gradualism governs the thinking of current Pentagon leaders. "Many of us here who are in this position now were in Vietnam, and that has left a profound impact on our feelings about how our nation ought to conduct its business," explains Gen. Charles Horner, commander of U.S. Air Force units in Saudi Arabia. "We think that war is a very seri-

ous business and it should not be dragged out in an effort to achieve some political objective."

Central to the notion of winning quickly is the belief that every advantage in technology should be employed to stun, cripple, and defeat an enemy. The army of the future "must be lethal," Gen. Vuono wrote in 1990. "Lethality results from quality soldiers . . . equipped with weapons that are superior to those of any adversary and available in numbers adequate to defeat potential enemies."

Gen. Norman Schwarzkopf accentuated the point in September when discussing U.S. plans for a war with Iraq: "We would be using capabilities that are far more lethal, far more accurate, and far more effective than anything we've ever used."

The implication is clear: there will be no gradualism, no restraint on firepower. The president underlined the precept in November: "Should military action be required, this will not be another Vietnam; this will not be a protracted, drawn-out war. . . . If one American soldier has to go into battle, that soldier will have enough force behind him to win, and then get out as soon as possible."



An MIC "Wish List"

From these maxims came the U.S. battle plan in the gulf, and from them is emerging the military doctrine of the 1990s. If fully adopted, this doctrine will have an enormous impact on U.S. foreign policy, inviting a military response to disagreements that will inevitably arise with emerging regional powers in the Third World. The MIC doctrine has already begun to govern the organization of U.S. forces and the development of hardware for the years ahead.

Although their plans had proceeded only slightly by August 2, senior officers had begun in early 1990 to hammer out a blueprint for combining arms and combat forces to serve U.S. needs in future mid-intensity conflicts. Since August, while improvising in Saudi Arabia, Pentagon officials have stepped up development of an MIC master plan. Operation Desert Storm, combined with what is known of the Pentagon's still-incomplete plans for MIC, suggests what weapons and forces are likely to dominate the military's funding "wish list" for the 1990s.

■ *Strategic mobility:* U.S. forces would have to arrive quickly and in enough strength to overcome formida-

ble foes. This means possessing ships and aircraft to transport hundreds of thousands of troops to distant areas and sustain them there for months or years. "Even the most combat-ready land force cannot protect our national interests if it cannot deploy sufficient combat power to the fight in time to make a difference," Gen. Vuono observed in April 1990. Arguing that U.S. mobility is inadequate, he called for investing more in airlift and sealift equipment.

Faced with the task of rapidly moving troops to the gulf, the Defense Department has emphasized this point even more since August. While the Pentagon has generally scored well for the speed and efficiency of the deployment, a number of logistical shortcomings have appeared, particularly with moving heavy items like tanks. A likely beneficiary of this assessment is the C-17

weapon that uses high speed to punch through heavy tank armor, and "smart" submunitions for antitank bombs and missiles.

■ *Advanced tactical aircraft:* To back up ground forces, the Pentagon will continue to rely on tactical airpower. As in Operation Desert Storm, air support will be provided by late-model F-14s, F-15s, and F-16s, plus the F-117A stealth fighter.

Since combat planes must overcome modern fighters and air defense systems of Soviet or Western European manufacture, Air Force officials insist they will need a host of more capable aircraft. Thus the Pentagon is developing the Advanced Tactical Fighter (ATF). To select the final ATF design, the Air Force is financing two experimental models: the YF-22A (designed by a joint Lockheed-Boeing-General Dynamics team), and the YF-23A (designed by Northrop and McDonnell Douglas). The Air Force will soon select one of these designs for production in the late 1990s.

■ *Advanced "standoff" missiles:* Given the growing effectiveness of enemy artillery and defenses, U.S. forces must be able to fire highly accurate missiles at air bases, command centers, military factories, tank formations, and so on from distant locations. Thus, the Pentagon is rushing forward with an assortment of standoff missiles—so called because they are launched from a helicopter, ship, or other platform well beyond the range of standard

defenses. These weapons—many of which were first used in the gulf conflict—employ sensors and microcomputers to locate, track, and strike targets.

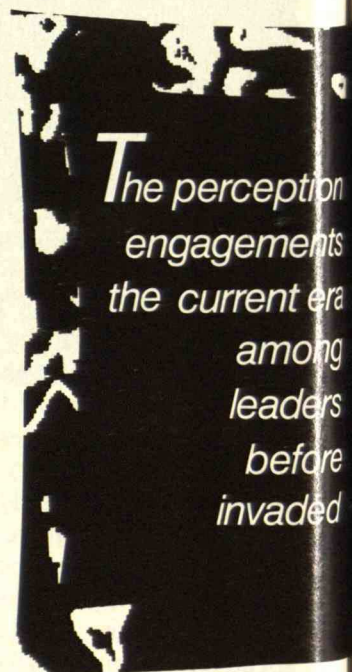
Heading the list of new and experimental standoff weapons are systems with names like Tomahawk, Paveway-III, SLAM, and HARM—names that are becoming familiar as a result of the gulf war. Most conspicuous so far is the Tomahawk sea-launched cruise missile (SLCM), a Navy weapon used for attacks on such targets as heavily defended command posts, factories, and nuclear reactors. Paveway-III, also known as the GBU-24, is a laser-guided bomb, apparently the one featured in some of the most dramatic TV footage of the war. The SLAM (Standoff Land-Attack Missile) has been used by carrier-based aircraft to attack Iraqi ports and other targets. The HARM (High-Speed Anti-Radiation Missile) rides the electronic signal given off by tracking radars to home in on and destroy air defense installations.



long-range cargo plane, a frequent target for congressional budget-cutting in the past.

■ *Mobile firepower:* Against well-equipped, professional armies, U.S. forces must wield potent weapons that can be moved quickly to a distant battle. In the view of many military experts, the highest priority is for a light tank-killing vehicle that can be air-lifted to where it is needed. To this end, the Marine Corps recently contracted with Cadillac Gage Textron to place a 105-millimeter assault gun on its Light Armored Vehicle; the Army is looking at similar options.

Other ground combat systems likely to figure prominently in a mid-intensity conflict are advanced missiles, rockets, and artillery. For destroying tanks, the Army is counting on the Advanced Antitank Weapons System-Medium (AAWSM), a shoulder-fired missile to replace the Dragon antitank missile, along with an upgraded version of the venerable TOW antitank missile. In development is the Kinetic Energy Missile, an anti-tank



The Pentagon is also using the Persian Gulf conflict to test and refine even more advanced standoff missiles. Tacit Rainbow, now in final development, is a loitering cruise missile that, like HARM, homes in on electronic signals. The Air Force is developing an advanced cruise missile as well as AGM-130, a television-guided, rocket-powered bomb. And the Army is proceeding with development of its new Tactical Missile System (ATACMS) following its initial combat firings in the Persian Gulf.

■ *Anti-tactical ballistic missile systems:* Because potential adversaries have their own cruise and ballistic missiles—notably the Scud—Pentagon officials avidly seek defensive systems. Generically known as anti-tactical ballistic missiles (ATBMs), such weapons are often described as the tactical version of the Star

Wars system proposed as a shield against Soviet ICBMs. Making the link explicit, the Strategic Defense Initiative Organization (SDIO) has given Israel \$158 million to develop the Arrow, an experimental ATBM to intercept the Scud and other intermediate-range ballistic missiles. And while allied forces now rely on the Patriot missile, the SDIO is also developing a U.S. ATBM, the ERINT (Extended-Range Interceptor) for shooting down missiles more advanced than the Scud.

■ *Command, control, communications, and intelligence:* In high-tech battles,

U.S. forces would need to rapidly detect enemy movements, communicate intelligence data, and pass battle orders through the chain of command. Thus, “C³I” systems (for command, control, communications, and intelligence), are considered especially vital for fighting unfamiliar adversaries in unknown and forbidding terrain. By enabling commanders to initiate lightning offensives and counterattacks, C³I will provide a critical advantage against superior numbers.

U.S. C³I will rely on satellites more and more. Key links are the Defense Satellite Communications System and the NAVSTAR Global Positioning System, along with assorted spy satellites of the Central Intelligence Agency and the Defense Intelligence Agency. At least six such satellites were used to pinpoint the location of Iraqi missile sites and other key military installations for attacks by U.S. bombers.

For precise, immediate data on enemy movements,

U.S. commanders have J-STARS (Joint Surveillance, Target Attack Radar System), a radar-equipped plane that locates tanks, helicopters, and low-flying aircraft. Also for spotting ground targets is the just-deployed LANTIRN (Low-Altitude Navigation and Targeting Infrared System for Night), an electronic pod attached to F-15 and F-16 fighters. Closer to the battle, troops might use small pilotless planes to fly over enemy formations and send back images.

■ *“Middleweight” combat formations:* MIC operations will require new types of combat brigades and divisions. So far, all the Army has is heavy divisions for massive tank battles in Europe and light divisions for Third World police operations. As Desert Shield soon proved, neither is ideal for MIC—heavy divisions can’t be moved quickly, and light divisions are essen-



tially defenseless against armor and artillery. What is needed, in the view of many strategists, are mid-weight forces tailored to mid-intensity conflict. Such forces, according to military analysts at the Center for Strategic and International Studies in Washington, D.C., should possess “the firepower, mobility, and survivability of heavy divisions, but [be] as rapidly deployable as light infantry divisions.”

Although strategists are just beginning to think about the shape of these forces, presumably they will be bigger than the existing 10,000-troop light infantry divisions and have fewer tanks and armored fighting vehicles (AFVs) than existing armored and mechanized divisions. One proposal circulating in Pentagon corridors calls for mobile armored forces equipped with some combination of AFVs, light armored vehicles, and missile-armed HMMWVs (High Mobility Multipurpose Wheeled Vehicles, as the Army calls its jeep replacement).

The Road Not Taken

Fully implementing this blueprint would undoubtedly provide the Pentagon with strong and versatile forces for mid-intensity conflicts. The unequivocal U.S. military success in the Persian Gulf appears to lend considerable legitimacy to this model. Moreover, many analysts will say this is unassailable confirmation of the lessons learned from the Vietnam War. And for some policymakers—certainly senior Bush Administration officials and many members of Congress—the threat from emerging powers justifies whatever investment is required for these capabilities.

Still, the costs will be staggering. Procuring new systems and replacing the equipment expended or destroyed in the Persian Gulf will cost hundreds of billions

of dollars. The same billions of dollars might otherwise be available for reducing U.S. budget shortfalls. Investing so much technological talent in weapons also diminishes the resources available for developing civilian products that might enhance U.S. competitiveness.

Paying for the Persian Gulf conflict and all the new weapons the Department of Defense seeks will encumber the U.S. Treasury for years to come, consuming resources desperately needed to rebuild cities, rehabilitate industries, and restore

damaged ecosystems. These costs will not be shouldered with equal equanimity by all Americans. The drain on resources, which might erode the long-term health of the economy, could provoke widespread dissent and disorder.

An MIC-oriented military posture will also likely result in repeated U.S. involvement in conflicts of the gulf variety and could produce a tidal wave of anti-Americanism. Many Arab and Moslem communities—including those opposing Saddam Hussein—are dismayed by the massive destruction in Iraq and are likely to resent the United States and its allies for years to come. Rather than departing the gulf as soon as the fighting ends, U.S. troops are likely to remain indefinitely to maintain Mideast stability and protect pro-U.S. Arab governments against the internal unrest that could ensue from their complicity in destroying Iraq. What's more, Israel, and possibly other friendly nations, will demand a cornucopia of new weapons to defend against their neighbors, further boosting the U.S. military bill.

Added to all this is the risk of recurring involvement in

Third World power struggles that could escalate into major conflagrations. If the premise of U.S. strategy is that we will probably come into conflict with emerging powers intent on "working their own agenda" (as the Air Force has put it), and that therefore we may wind up "confronting a well-equipped army in the Third World" (as suggested by Gen. Vuono), then just that is likely to happen—as it did four months after Vuono uttered his prophetic words.

This is not to say that the military offensive against Iraq was planned before the invasion of Kuwait, or that U.S. forces were spoiling for a fight. Rather, it is to suggest that an MIC-oriented doctrine encourages a militant response to overseas developments. That, in turn, could lead to quick military action.

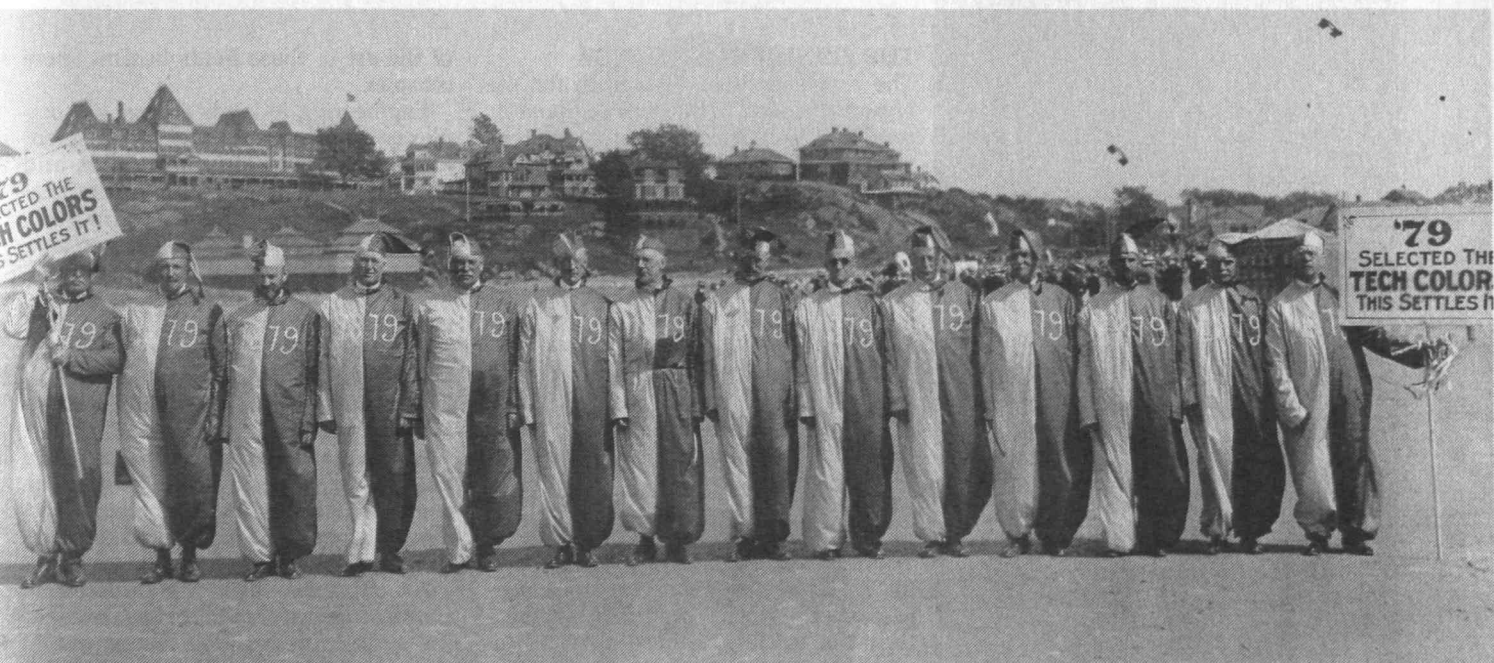
Because U.S. forces are likely to be permanently stationed in remote and inhospitable locales, we can expect a decline in voluntary military enlistment—prompting vigorous calls from Congress and the Pentagon for reinstituting a draft. This, too, could provoke understandable opposition from those unfairly burdened by the steady erosion of domestic programs.

Finally, despite the president's fervent dreams for a new world order, a policy designed to demonstrate our superpower status while advancing America's geopolitical and economic interests is unlikely to result in international cooperation. Rather, it will produce a new *Pax Americana* in which U.S. soldiers are the principal instrument of regional stability. We may receive benefits from this policy, but we could also pay a heavy price in blood and in the continued decline of our cities, civilian industries, and natural environment.

Given this assessment, it is essential to seek alternatives to intervening against aggressive regional powers. To give just one example: the world community could have imposed rigorous non-proliferation measures on Iraq years earlier. Instead, from 1985 to the spring of 1990, presidents Reagan and Bush approved the sale to Iraq of \$1.5 billion worth of advanced scientific gear, much of it of obvious military utility. They endorsed massive arms sales to Iraq by France, Brazil, and other Western nations as well. The Soviet Union and China also contributed to Baghdad's military potential, and many nations participated in the flow of advanced military technology to Iraq—including technology for developing nuclear and chemical weapons. Had these military transfers been blocked, Hussein would not command the massive arsenals now at his disposal and probably would have been much more wary of military adventurism.

Strengthened international efforts are needed to curb the spread of advanced military technology and discourage adventurist potentates. Such measures may not be foolproof, but they provide a substitute to intervention and should be thoroughly tested before the United States commits itself to a strategy that will lead to recurring military involvement in regional conflicts around the world. ■

If the premise of U.S. strategy is that we will probably come into conflict with emerging powers, then just that is likely to happen.



Well, not quite. It was June 1916, and MIT graduates were celebrating the Golden Jubilee Reunion. They were arrayed along Nantasket Beach, costumed, in formation, with suitable props, for "class stunts." And ever the sticklers for detail. Everyone agreed that the Institute colors of cardinal red and silver gray were first adopted in 1876. But 40 years after the fact, the four classes on campus in 1876, now gentlemen of substance close to 60 years old, were still debating which class had first proposed these exact colors. The scene on the beach was but one skirmish in a war that occupied countless hours of the class secretaries and page after page in *Technology Review*. Memories were vague and hard evidence was limited, so the issue remained moot. But you have to admire their class spirit.



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COVER
With MIT celebrating the 75th anniversary of its move to Cambridge this spring, the time is ripe for heading into the Archives. Coming in the July issue, "The Masque of Power."
Photo: MIT Museum

THE PRESIDENT'S AGENDA

The article entitled "Priorities for the New President" (November/December, page MIT 9) is a collection of opinions written by 10 faculty and alumni leaders on the issues facing the new MIT president. Unfortunately you chose not to include opinions of any students. This omission seems regrettable, given that the questions posed in the introduction to the article deal with the future directions of MIT's educational programs. Undergraduate and graduate students are key players in such programs and deserve to have their views known to the alumni community.

Michael D. Grossberg, G
President, Graduate Student Council

Your recent presentation of "Priorities for the New President" included suggestions by two senior faculty members that the undergraduate curriculum should be extended from four to five years, presumably to develop a more rounded professional engineer. Other faculty members took issue with the premise that more liberal arts courses should be introduced into the undergraduate engineering curriculum. As a structural engineer in private practice and former MIT faculty member, I am convinced that any proposal to increase the undergraduate curriculum from four to five years would be a serious mistake.

It is indeed true that educating an engineer for practice in the current and future state of the art requires more than four years. In fact, as I know the practice of structural engineering, an undergraduate degree, a minimum of two years of professional education, and one year of resident experience are the absolute minimum requirements to assure public safety in the design of buildings, bridges, and other structures. A five-year undergraduate program that only broadens the background of young engineers would mean one more year of effort and expense for the would-be engineer before he or she could obtain a real professional education.

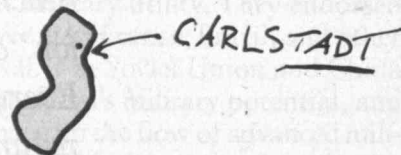
Education for doctors, dentists, and lawyers did not always include requirements beyond a four-year program. Graduate professional education requirements were introduced as the state

of the art in these fields became more complex.

Engineering today is at least as complex as law, dentistry, and general medicine; yet our registration laws and engineering schools continue the charade that an undergraduate engineering education can ensure adequate performance as a professional. In structural engineering, for example, it is all too evident from the number of collapses of major structures and the host of lesser failures that the education of engineers and the structural design of buildings and bridges must be improved to protect public safety. Change will require heightened concern on the part of the engineering professions, public authorities, engineering schools, and the public.

An improvement in the professional status of engineers will only take place if the need for change is recognized by the premier engineering schools, such as MIT. The schools themselves must change the engineering curricula and participate in updating both the requirements for registering engineers and the systems for practice. Only then will the engineering faculty and alumni/ae fulfill their obligation to protect public safety and advance the professional status of engineers in the eyes of the public.

Frank J. Heger, '48
Arlington, Mass.



Regarding "The Boxcar ID System in Your Grocery Store" (January, page MIT 44): I was thrilled to see that the first use of the bar code system was at General Trading Corp., right here in little Carlstadt, N.J. The rest, the authors say, is history, but this bit of history will be forever wrong unless corrected now.

There is no "Carlsbad, N.J." Carlstadt, N.J. has an interesting history of its own, but do not deny it this little additional claim to fame.

Robert Kern, Jr.
Carlstadt, N.J.



ALUM· NEWS

Class of '91 Gift Targets K-12 Education

The Class of '91 is raising money for the MIT Teaching Fund, a five-year experiment designed to free graduates to take traditionally underpaid public school teaching jobs by forgiving a portion of their educational loans.

As reported in *The Tech*, this class gift was agreed on after a survey of seniors and a series of open discussions. It was greeted with enthusiasm by Dean for Undergraduate Education Margaret MacVicar, '65, who lauded it as the "first formal statement by students of the Institute endorsing K-12 as a career focus." MacVicar's is one of many voices at MIT calling attention to the crisis in elementary and high school education nationwide, particularly in science education, and urging her colleagues to become involved in improving public schools.

Working with members of the Alumni/ae Association staff to plan their gift and fund raising, the Class of '91 gift committee has adopted a fairly sophisticated strategy. The committee is encouraging classmates to think about their growing earning power when making their pledges. "We envision students pledging, for example, \$250 over five years," says committee member Jason Slibeck, "giving \$25 in the first two years, then when . . . they can afford more, they'll increase, say, to \$50 the third year and \$75 the fourth and fifth years." The class goal is \$60,000 over the term of the fund.

At the end of five years, the committee will review the effectiveness of the teaching fund. They are hopeful that if the program is successful, the Institute will take it over. □



Emma Rogers Society Keeps Widows in the MIT Family

Over the years, the spouses of MIT graduates often come to feel very connected to their mate's alma mater and class, sometimes their academic department. The same is true of the spouses of faculty members. Attending reunions, club and department activities, and special MIT-sponsored events, socializing with classmates and other MIT colleagues, and seeing close up what an MIT education can mean in one's life—all these create powerful emotional, social, and intellectual ties.

When MIT graduates or faculty members die, their widows continue to value those friendships and associations, but until recently, their connection to MIT was recognized only informally by the Alumni/ae Association and the Institute. No longer. Now there is the Emma Rogers Society, named for the wife of MIT's founder and a player in her own right

in early Institute history.

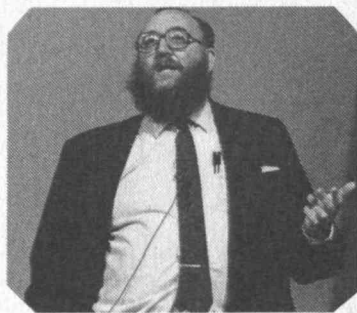
Membership in the society is free and automatic, and members are put on the society mailing list as soon as MIT receives information about their bereavement.

The society was established only last fall, but it already boasts a record of popular initiatives. Notable is the "Insider's Series," a succession of one-day events that give society members a close look at activities on campus. Twenty-nine members of the society came from all over the country for last October's inaugural session on hip replacement and cancer research, which was followed by winter gatherings titled "A Friendly Look at Computers" and "The Arts at MIT."

Forty-six members of the society attended "Gaining Control: A Financial Issues Seminar," presented by executives from the investment house that manages the MIT endowment. The society hopes to offer programs on medical insurance and estate planning. Audio cassette recordings are available from some society events.

A variety of volunteer committees of the Emma Rogers Society are focusing on activities like outreach to the recently bereaved and the special needs of young widows with children. The society also published the first issue of *In Memoriam*, a booklet that lists the names of all deceased alumni/ae and faculty in whose name donations have been made in the past year, as well as the names of all alumni/ae and faculty in the history of the Institute for whom endowed memorial funds have been established.

Activities have so far been held in Cambridge, but MIT is looking to develop programs in other parts of the country, according to Betsy Millard, program manager. Millard can be reached at 617/253-8059 for further information. □



Joel Moses

Moses Succeeds Wilson as Dean of Engineering

Joel Moses, PhD '67, the Dugald C. Jackson Professor of Computer Science and Engineering, has been appointed dean of the School of Engineering. He succeeds Gerald L. Wilson, '61, the Vannevar Bush Professor of Electrical and Mechanical Engineering, who had been dean since 1981.

Moses, renowned for the development of MACSYMA, the largest computer system for symbolic algebraic manipulation, served as head of the Department of Electrical Engineering & Computer Science from 1981 to 1989.

There were many strong candidates for the position of dean, said Provost Mark Wrighton when announcing the appointment, but after careful evaluation he concluded that "Joel Moses represents the very best person for the School of Engineering and the Institute. His achievements in research and educational activities establish him as an intellectual leader. He has the vision to initiate important new programs and the commitment to follow through on the exciting developments started under the guidance of Dean Wilson."

Moses, a member of the faculty since 1967, is recognized for making significant contributions to both computer science and computer engineering. As a computer scientist, he is known for his work on the theory of algebraic manipulation algorithms in the areas of simplification and integration. As a computer systems engineer, he is best known for applying his theoretical results to the development of MACSYMA,

a system that enables computers to carry out exact differentiation and integration of complex expressions as well as symbolic solutions of equations.

A native of Israel, Moses came to the United States in 1954. He received a BA and MA in mathematics from Columbia University, came to MIT for a PhD in the same field, and joined the faculty in 1967. He was associate director of the Laboratory for Computer Science from 1974-78, and associate department head of EECS for computer science and engineering from 1978-81. Last year he was a visiting professor at the Harvard Business School. □

Tuition Up 7.4%

Next year tuition and fees for an undergraduate education at MIT will rise to \$22,230, a 7.4 percent increase. Room and board will increase by \$230 and tuition by \$1,300. The hike is necessary to maintain MIT's long-standing policy of need-blind admissions, according to President Charles Vest, "which is critical to maintain freedom of opportunity in a society increasingly dependent on scientific and technical knowledge."

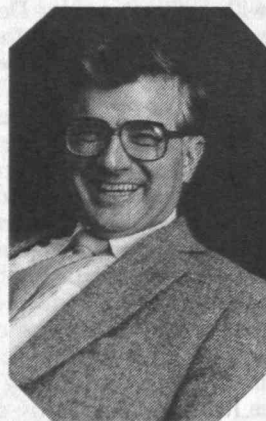
This year, 57 percent of the undergraduates received financial aid (long-term loans, student jobs, and scholarships) from MIT. A typical financial aid package to help pay this year's \$20,700 price for tuition, room, and board included \$10,600 in scholarship, \$4,000 in loans, and \$1,700 from student employment.

"MIT has excellent students; they have moderate wallets," said Vest. Over the past five years, MIT has admitted and supported an increasing number of students from families who are in the lowest national quartile for family income. The Institute's self-help level—the amount students are typically expected to provide from loans and term-time work before receiving scholarship assistance—was raised \$400 for next year, or seven percent, to \$6,100. MIT reduces the self-help requirements for students from families of extremely low income; the lowest requirement next year will be \$2,000. □

Some Changes

■ Professor Kenneth A. Smith, '58, associate provost since 1980, vice-president for research since 1981, and director of the Whitaker College of Health Sciences and Technology, has resigned those positions to return to teaching. He is also the Edwin R. Gilliland Professor in the Department of Chemical Engineering, where he is teaching a subject in analysis of transport phenomena this semester.

Provost Mark S. Wrighton observed that Smith "has been responsible for on-campus research, which this year amounted to about \$300 million, during a decade of significant change in both the sources of research funding and in public and governmental perception of what is an appropriate role for a university. As a frequent and effective



Ken Smith

spokesman for MIT, he has articulated clearly the nature of a research university and the important linkage between education and research. Internally, although it is the lot of provosts and associate provosts to have to say 'no' quite often, his natural commitment to consensus building and leadership in making difficult decisions understandable was always readily apparent and was highly appreciated."

Smith, who also received an SM and PhD from MIT, is an expert in fluid mechanics and heat and mass transfer. He has published extensively in the areas of polymer characterization, desalination, liquefied natural gas processing, and biomedical engineering.

■ Professor J. David Litster, PhD '65, has been named to fill the three posts vacated by Smith until a permanent replacement is named. Litster has been director of the Francis Bitter National Magnet Laboratory since 1988, and was director of the Center for Materials Science and Engineering for the five years before that.

A member of the Department of Physics, Litster is widely recognized for his work in phase transitions and statistical mechanics. Since 1986, he has been a member of the National Research Council's Solid State Sciences Panel and regional editor of *Molecular Crystals and Liquid Crystals*.

■ Gene M. Brown, dean of science at MIT for the past six years, has announced that he will step down from that position at the beginning of June. A professor of biochemistry and former head of the Department of Biology, Brown will return to teaching. Commented Provost Wrighton, "Gene Brown has served MIT well as a faculty member and administrator. While he was head of biology, he contributed significantly to its development as a world-



Dave Litster

class department, and as dean, he provided school-wide leadership." The School of Science includes the Departments of Biology, Chemistry, Physics, Mathematics, and Earth, Atmospheric, and Planetary Sciences. Interdisciplinary labs and centers associated with the school include the Center for Cancer Research, the Center for Space Research, the George Russell Harrison Spectroscopy Lab, the Laboratory for Nuclear Science, and the Experimental Study Group.

Brown, who joined the MIT faculty in 1954, has focused his research on the isolation, biosynthesis, and function of vitamins, coenzymes, and related substances.

■ Former provost John Deutch, '61, unsuccessfully wooed by Harvard to fill a long-vacant endowed chair, the Pierce Professorship of Technology and Public Policy, has been named an Institute Professor at MIT. The title, the highest bestowed by the MIT faculty and administration, recognizes distinguished accomplishments in scholarly, educational, service, and leadership pursuits. There are usually no more than 12 active Institute Professors at any one time; currently the number is 9, with 21 Institute Professors Emeriti.

Following the announcement, Deutch told *The Tech* that he was "enormously pleased and honored. This is the third best thing that's happened to me at MIT," he said, explaining that the first was being admitted as a student to MIT and the second was being hired as a professor.

Deutch, who stepped down as provost last October, had served as dean of the School of Science from 1982 to 1985, and as head of the Department of Chemistry from 1976-77. Until his appointment as Institute Professor, he was the Karl Taylor Compton Professor of Chemistry. □

At the time I registered in ProNet I was not actively looking for a position. However 4 months after I registered, I was introduced to a surprisingly good opportunity, which resulted in my present new job. I think ProNet is a great idea, I was pleased with the service, and I would definitely recommend it.

Alan Wadsworth '82

Whether or not you're currently looking for a job, people do make offers you can't refuse. The MIT ProNet service is designed to keep you abreast of challenging opportunities in a variety of fields, including: High-tech, Venture Capital, Fortune 500, Start-ups, Bio-tech, Aerospace, and many more.

It's easy and it's confidential. For more information write: MIT ProNet, Registration Department, MIT Alumni Association, 77 Massachusetts Avenue, Cambridge, MA 02139.

MIT ProNet... it works.

A Meeting with Chuck Vest



Technology Review editor Susan Lewis met with Charles M. Vest in January. In a wide-ranging interview, he shared his thoughts on some of the issues facing MIT.

TR: You have said that you think the definition of MIT's mission is not as clear as it might be. Could you elaborate?

VEST: During the first months after my appointment was announced, I spent a lot of time interviewing the faculty, students, and staff around the campus. I came away from that with a sense that MIT is a little lacking in its own self-definition and long-term goals at the moment.

I think this is entirely natural. MIT as we know it evolved largely from the post-World War II era. It is built on the legacy of the Radiation Lab-

oratory and was shaped by great intellects such as Norbert Wiener and Victor Weisskopf. The postwar development of MIT was embedded in the contexts of a rapidly expanding economy, the world's strongest mass-production industrial base, and the Cold War. It developed in an era in which higher education, particularly that handful of elite institutions such as MIT, was highly respected by both the federal government and the public.

All of these contextual factors are changing today. The generation that gave MIT its postwar sense of mission either has retired or will soon retire, and there are new people here with new kinds of backgrounds. The Cold War has, we hope, ended. The United States

finds itself in a totally different relationship with the world as we become increasingly interconnected—socially, intellectually, economically—in ways heretofore nonexistent. Our economy is soft, and the once automatic respect of the public and the federal government for our great universities is flagging, or at least changing.

When I say MIT needs to redefine its mission, it's not at all in a critical manner; in fact, just the opposite. As the world changes rapidly about us, this is a terribly exciting time for the whole community to think through what it is that, in the great MIT tradition, we can do even better to serve our nation and the world. We trust that the fundamental concepts of MIT as the greatest insti-

tution in the world centered on science and engineering, that attracts the very best and the brightest in these areas of study, will never change. But it remains to be seen exactly what are the greatest service, education, and research roles that we can play in the future. I believe they will be somewhat different than they have been during the past two or three decades.

TR: *Do you see a larger proportion of research at MIT funded by industry in the future?*

VEST: Ideally, I'd like to see a very balanced set of funding sources for research—well balanced across federal agencies and industrial sectors, and across international corporations as well. However, being realistic, I doubt that we are going to see a dramatic shift in research funding by government or the private sector.

Having said that, I do believe MIT will undertake new initiatives, for which the Commission on Productivity was perhaps a prototype, that will attract increased industrial support. Through such activities, MIT will seek to enhance the competitiveness of U.S. industry and to be a careful analyst of our industries and a source of good counsel and new knowledge to them.

TR: *Do you see more difficulty today in funding basic science, research that isn't mission oriented and is unlikely to yield short-term practical results?*

VEST: In a number of areas, that question is beginning to have less meaning. One might think about telecommunications, some topics in modern biology, computer science, or materials science—the boundary between what is basic research and what is applied research has become increasingly fuzzy. The amount of time between a fundamental discovery, a prototypical application, and finally implementation has become very short. What is basic and what is applied may not be very different.

I do see evidence, however, that, pressed by short-term considerations associated with industrial competitiveness, this nation no longer values the discovery of new know-

ledge at a very fundamental level. I think it is something we should be very concerned about, because the things that may seem basic or irrelevant one year may turn out to have tremendous practical importance five years or a decade later. We need to regenerate enthusiasm on the part of government agencies and our populace for truly fundamental research.

TR: *Do you think that NSF's decision to award the contract for a National Magnet Laboratory to Florida State University instead of keeping it at MIT's Francis Bitter Laboratory signals a reduced emphasis on the peer review process as the basis for federal research funding?*

VEST: I certainly hope that the National Science Foundation decision of last August regarding the Francis Bitter National Magnet Laboratory was an aberration. Let me be clear, however: MIT in no way considers that the Florida consortium used improper political influence or techniques in this decision. We view this as an unfortunate decision within the staff of the NSF that in turn influenced the ruling of the National Science Board. In that sense I believe it is an aberration in a long and effective partnership, and we are working on further proposals to the NSF and later to other agencies to revitalize the Francis Bitter Laboratory.

Although I don't regard the Magnet Lab as a primary example, I am terribly concerned about the increase in considerations beyond the quality of researchers and the quality of proposed projects in federal funding decisions. The locus of science funding policy is shifting out of the executive agencies directly into Congress. The most troubling form this takes is the outright earmarking of projects that simply make no sense whatsoever.

Every year we see escalation in the percentage of R&D budgets that are sidetracked by earmarking. This type of pork barreling usually does not mean new money coming into the research and development pot; it means existing funds are redirected.

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The reasons for increased earmarking are perfectly understandable. We are in constrained economic times, and voters believe that infusions of R&D monies into their local universities can have a positive effect on the local economy. Further, there is a strong populist tendency within the Congress that fosters a belief that research funds are too concentrated in a modest number of world-class public and private research universities.

In my view, the logic should be the opposite. When the budget is constrained is the very time to think the hardest about how to invest tax dollars wisely. I would underline the term invest, because the research and education components of the federal budget are just that: investments in the future of the United States through the development of human capital and new ideas and technologies. What will best serve the nation in the long run is supporting research and educational programs primarily on the basis on their absolute quality.

TR: *Has MIT thought about opening an office in Washington?*

VEST: I intend both personally and institutionally to be much more aggressive in telling the MIT story in Washington and in having a strong presence there. Research universities can no longer afford to deal only with the leadership of the various mission agencies; we must now be very careful to interact with Congress and others within the administration.

MIT, as in the past, continues to have very effective ties with Washington through its individual faculty and administrators. But I think we have to tell a somewhat more coherent story in the political atmosphere of the 1990s.

I have been spending a minimum of one day a month in Washington, starting last July. I simply go down and saturate the day with appointments with key people in Congress, the agencies, and the White House. These meetings allow us to know each other and allow me to project something of my vision for MIT and

for MIT's importance to the nation. These meetings are also a chance to make the expertise among our own faculty available to people in Congress and the agencies.

TR: *Do you see the role of the president of MIT as a national spokesperson?*

VEST: The president of MIT, by definition, becomes a spokesperson for many issues, particularly the importance of science and technology and the educational aspects thereof. I've referred to this in the past as being a great bully pulpit, and one that I hope I have the wisdom to use effectively over time.

Right now, it is somewhat frustrating for me to hold back and not immediately jump in with my opinions as issues come along. But given the power and importance of the MIT presidency in the world, it needs to be used very carefully. That's one of the reasons I've launched a number of exercises within the Institute to consider in depth issues on which MIT and its leadership should take a position.

One committee, for example, will provide policy advice about the appropriate connections between research universities and foreign governments and corporations. As the internal discussion comes to closure, I'll do my best to speak forcefully on the national scale. My goal is to have a positive effect on science and engineering and higher education in general, as well as on the Institute.

TR: *So this committee is looking at issues such as the ones involved in the New York Times article critical of the Media Lab's contracts with the Japanese?*

VEST: We have two broad sets of concerns about interactions between American universities in general and foreign countries. One is to identify the great opportunities and the duty that we have to shape the education and the activities of our students in ways that prepare them to operate in an internationalized working and living environment. That's the fun part of it, and it is ultimately the most important part.

The other concern is that the Institute and other universities have been subject to criticism for receiving support from other countries, in particular from Japan. The very unfortunate and, in my view, unfair article in the *New York Times* about the Media Laboratory—while it is an example of the kind of criticism that is out there—is a tempest in a teapot. The Media Lab contract with Nihon University is an example of an agreement in which there was a strong two-way street, and there has been nothing inappropriate about it.

That is not to say that U.S. universities do not have an obligation to think very carefully about what is and isn't appropriate in our overseas interactions. For example, I would like to see us increase our ties with foreign corporations and individuals but at the same time broaden the number of countries involved. A deeper involvement with Europe is one objective. And as we do this, we need to ensure that there is a reasonable level of reciprocity in our relationships, that there are benefits to MIT and the United States as well as benefits of further knowledge for our overseas partners.

It would be with the greatest reluctance that we would consider any actions that would close off the flow of knowledge from American universities. It would be a terrible mistake to retreat into a sort of isolationist techno-nationalism on the basis of very short-sighted concerns. U.S. industries have found that increasing rather than decreasing their international activity is necessary to be competitive in today's world. I think if universities think it through, we, too, will come to the same conclusion.

TR: *Demographics tell us that the majority of the work force in the coming century will be people of color and women—two groups that are underrepresented in the scientific and technical professions. And experience suggests that only when they have role models among the faculty and industrial leadership will large numbers of minorities and women become fully vested players*

in science and technology. MIT has documented the fact that a substantial fraction of the engineering faculty at U.S. universities hold Institute degrees; doesn't that give MIT a particular responsibility to bring more women and minorities into the faculty "pipeline"—its graduate programs?

VEST: I believe it does. I have frequently said that if MIT is to be a leader 10 or 20 years hence, in the same sense that it has been for the last 30 or 40 years, then it's going to have to more accurately reflect the changing makeup of the population. The most important thing in my view is that we set it as part of our mission and work through continuous improvement toward that goal.

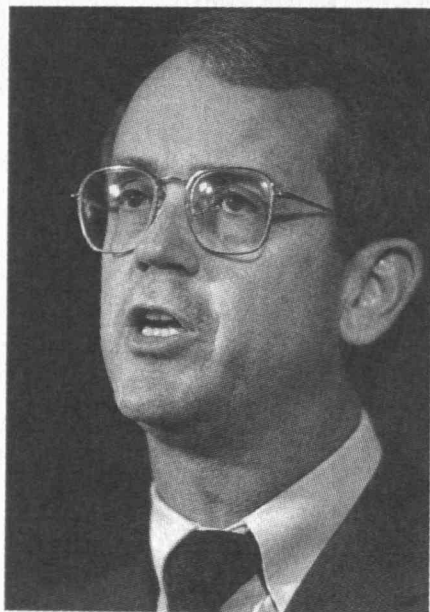
During the last decade, the Institute has been successful in attracting increasing numbers of women and minorities to the undergraduate program. We currently have around 34 percent women in our undergraduate program and about 14 percent underrepresented minorities, which compared with other engineering and science-based colleges or universities is extremely good. But across the country, progress at the undergraduate level, particularly in gaining minority students, has been very slow to diffuse into the graduate programs.

I think a number of things have to happen. First of all, industry must give minority students encouragement to earn master's or doctoral degrees. Sometimes companies are understandably eager to hire minority students in particular, and to an extent women as well, and they encourage these students to move into the corporate world.

Universities must provide—and are providing—graduate fellowship programs that attract minority students and women into areas of graduate work where they traditionally have not been well represented. We must make it a part of our own faculty culture to encourage bright minority and women students to go into graduate programs. And we need to increase our own sensitivities to the particular stresses experienced by a person who goes into an



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area of study, a laboratory, or a department where there are very few similar people. If we do all that, over time we can begin to make substantial progress.

TR: *You have spoken of how much more control MIT has over the undergraduate admissions process, since it happens essentially in one office, where the administration can set policy and implement it. Graduate admissions, on the other hand, are handled in the academic departments. Are there mechanisms that can encourage enrollment of minorities and women Institute-wide?*

VEST: I believe it's less an issue of mechanisms than leadership. I think that the academic leadership of the Institute—from the president, through the provost, the deans, the department chairs, and the people administering graduate programs—simply have to have this as a goal. We have to be aggressive in recruiting minority and women students. Since the pool is quite small at the moment, we have to go the extra mile. That means getting on the telephone with our colleagues around the country to identify the brightest young men and women of this type. It means being a little more personal in the recruitment process.

TR: *You mentioned being sensitive to the experience of the first women or minority members to join a department or laboratory, which brings me to the Institute's recent massive study of harassment. What plans or strategies are in the works to deal with harassment and, ideally, to prevent it from happening?*

VEST: We have received a very carefully crafted report that I believe will increase awareness of the nature and the importance of the issue of harassment, particularly sexual harassment, on our campus. It makes a number of recommendations, but those involve no major changes in MIT's basic policy regarding harassment of any kind.

I absolutely believe that in this and every other university in the country, a range of behaviors are present that can be categorized as sexual harassment. Such behavior is terribly troubling to many members of our community, be they students, staff, or faculty.

We've generally been able to deal effectively with the truly egregious kind of behavior—and certainly could today. But we also need to be worried about the cumulative effects of things that, in and of themselves and in isolation, might appear relatively minor, but over time create a climate that is uncomfortable for many women in our community.

In my view the key to working productively in this area is education. MIT is producing what we hope will be effective educational activities about what constitutes harassment, what kinds of behavior are desirable to avoid or eliminate in an intelligent community such as ours. I believe that as people begin to understand this, the frequency of these problems will diminish. We also will provide clear and careful guides for students, faculty, and staff seeking help when such things occur.

TR: *How big a part did the humanities and social sciences play in your own education?*

VEST: Like most engineers of my generation, the amount of formal education I had in the humanities in my college years was very small. It was, however, a most treasured part of my education. Through the stimulation of my own faculty background and interests over the years, I have had a rather wide ranging curiosity and a love, perhaps a somewhat uneducated love, for music and literature and history. It has been a very meaningful part of my life that I try to draw sustenance from, and I try to pass some sense of my personal experience of the humanities to my students and colleagues.

TR: *Do you come at the curriculum discussions at MIT, which give substantial consideration to the potential role of humanities and social sciences, from any particular orientation?*

VEST: First of all, the ultimate decisions about the nature of the Institute's curriculum are properly vested in the faculty, and I do not see it as the job of the president to dictate the nature of the curriculum. At the same time, I do think that we should be increasing the amount

and quality of exposure that our science and engineering students have to the humanities, the social sciences, art, and music. That can be accomplished in a number of ways, and I'm not at all convinced that formal course work is the most important way.

The Institute has wonderful activities [outside the degree programs] in these domains, and we are seated in one of the great cultural capitals of the world. I think we need to look carefully both at the curriculum and also at the sort of environment we create for students. We need to encourage them to participate in the feast that surrounds them.

My personal belief is that most engineering students would benefit from some degree of broadening of their undergraduate experience, with encouragement for the brightest to continue on to graduate school to continue their technical and scientific specialization. Whether this will happen and the details of how it should be worked out are faculty decisions, in which I look forward to participating.

TR: *It has been my experience that faculty, students, and alumni/ae are almost split down the middle regarding questions of rigor and focus of the curriculum and diversity in the student body at MIT. Half seem to think that broadening the curriculum, including more emphasis on the human context in which science and engineering are conducted, and admitting students with a variety of backgrounds and interests are the best things that could happen to MIT. The other half are afraid that an MIT education is in danger of being "watered down." Do you see and hear these big clusters at the opposite poles of the discussion?*

VEST: I believe that the way that question is posed, which, by the way, is the way it often is posed, mixes too many things together. First of all, let me say unequivocally that I would hope that MIT will forever be one of at most two or three institutions that attract the very brightest young men and women studying science, mathematics, and engineering and provide them an educational environment in which they will be challenged and flourish.

And if the brightest students happen to be—at this point in their lives—the most highly focused mathematicians or computer scientists, MIT must have a place for them.

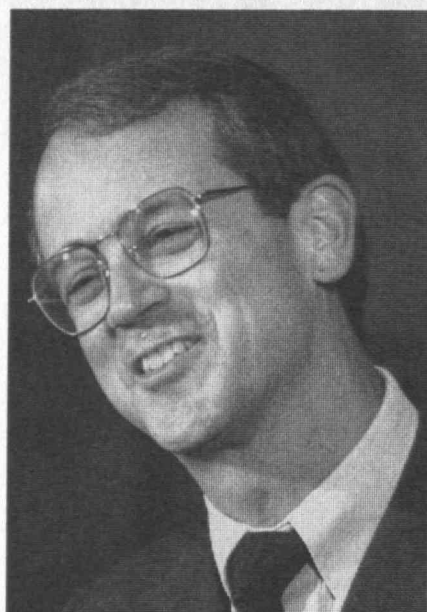
Having said that, I want to make two important points. First, the solutions to many of the problems facing our nation and world have major technological or scientific components, but those components do not exist in isolation. Problems must also be dealt with through tools of economics, political science, understanding of cultural and historical context, and so forth. MIT should contribute to the pool of students educated to function in these complex environments.

The second thing is that across the nation, during the last decade or so, young people have been attracted to engineering who simply have a much broader set of interests and activities than many engineers of other eras. Many young folks who in previous decades would have been inclined toward such fields as medicine or law have been attracted to engineering.

Confronting a world full of complex, interdisciplinary problems and a large, new constituency among our applicants means that MIT faces increasingly difficult decisions about the nature of its curriculum and the kind of people that we admit. I believe that the Institute should maintain very strong, absolute standards for admission. But when we see young people, as bright as their peers, who have a somewhat broader outlook on life, I hope that they can be accepted into the spectrum of MIT students. I think it is part of our leadership mission.

I do get very concerned when the debate about the quality level and breadth of interests among students gets automatically tied together with the issue of whether we are able to attract increasing numbers of women and minorities. We have seen, over the past decade and a half, the percentage of women in our undergraduate population grow from single digits up to about 34 percent. It may interest *Tech Review* readers to know that both the grad-

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uation rate and graduating GPA of those women exceeds that of the men in the Institute. So I do not buy the idea that building a diversity in gender, race, or ethnic background has some automatic connection with quality standards.

TR: MIT once had something called the Division for Study and Research in Education, which was disbanded in 1982. Should MIT again be thinking of some institutionalized expression of its concern for the state of K-12 education in this country?

VEST: We should be deeply troubled about the state of the K through 12 education system in this country. A major part of what should trouble us is the quality of science and mathematics education—and perhaps even more than education, the lack of inspiration for young people to enjoy and pursue science.

At present, MIT has well over 50 individual interactive programs with primary and secondary school students, teachers, or systems, centered around the interests of a particular faculty member, laboratory, or group. That's all well and good; it's good citizenship to do that. But I think it's time to find something profound and unique that the Institute could do, something that might be the 1990s analogue of the 1950s Zacharias Commission [which rewrote the high school physics curriculum].

There is an ad hoc group, first constituted by Dean Gerry Wilson in the School of Engineering a couple of months ago, now continuing on at an Institute level with my strong encouragement and that of Provost [Mark] Wrighton, that is trying to come up with a natural role for MIT in public education.

I do not believe, for example, that MIT should start an education school or take over a school district. That's not what we're good at, and that's not the kind of faculty that we have. More appropriate might be the development of innovative and inspirational curricula for grade school students or new ways of using computing and information technology as a learning tool. We might be able to bring science teach-

ers to the Institute for periods of renewal or encourage collaboration among schools by developing the telecommunications systems for school networks.

There is strong will across our faculty to roll up their sleeves and do something to solve this problem, if we can find a project that is a natural fit.

TR: A Made in America for education?

VEST: Exactly.

TR: You have remarked that you derived great satisfaction from your role in putting up a new building at the University of Michigan, because new facilities are a boon to effective research and help in recruiting top students and faculty. Are there some facilities issues that you see for MIT?

VEST: The fact of life in modern science and engineering research is that quality of facilities is extremely and increasingly important. In the old days, a blackboard and a simple laboratory bench were all that good research and education required, but today we need more sophisticated and expensive facilities, with highly controlled environments.

A good example is the absolute need of the Institute to build a new biology building, which will provide an improved teaching environment for biology and for several other departments as well as research facilities. It is our hope that we can raise the private funds to do this; if not, we will issue bonds. But we've got to get in the ground with that building if we are to enable our absolutely outstanding biology faculty and research staff to accomplish their goals. Beyond that, we do not see other large-scale projects on the near horizon.

We do face, as do most universities in the United States, an ever-growing list of deferred maintenance, and there are other areas whose future needs are going to become as pressing as biology's needs today. This is a terrible problem for the Institute, and for higher education in general, because the federal government is essentially out of the business of facilities construction.

There are modest attempts at rebuilding a federal role in scientific and educational facilities, but it's a tiny drop in the bucket.

This is also a time in which individual donors, for whatever reasons, are less attracted to the idea of putting up major facilities than they were in the past, and we must somehow break that cycle. We cannot allow our fine institutions like MIT to degenerate in the coming two decades the way they have been allowed to recently.

TR: *Is there any subject I didn't ask you about that you would like to comment on for alumni/ae?*

VEST: When I joined the ranks of higher education administration, and particularly since assuming the presidency of MIT, I noticed that in making the transition from faculty member to administrator, you become aware that a great university has many constituencies. Of course, our core constituencies are our faculty and students. Beyond that are our staff, the government, the nation's industry, the world at large, the agencies and corporations that sponsor our research, and our professional societies. But the constituency that I think gives a university the greatest sense of hope and vitality and enthusiasm is indeed the alumni and alumnae.

Although I have been president for only about three months, I've already had, for example, the opportunity to spend six days on the West Coast on behalf of MIT. I really came back with my batteries recharged. I think the amount of good will, the willingness to provide intellectual, emotional, and financial support for this great institution among our alumni and alumnae, is just tremendous.

I look forward to working with all of our alumni and alumnae, learning their views and seeking their support. I want to work with them with the goal of being able, 10 years hence, to look back and say MIT has retained and indeed enhanced its excellence in very troubled times. If that happens, the generosity and commitment of our alumni and alumnae will have been among the major factors. □

Investing Vest: the Inaugural Year

Charles M. Vest will be inaugurated as the 15th president of MIT on May 10, a ceremony that is conceived as a focal point in an inaugural year whose theme is "MIT—Shaping the Future."

Sensitive to the fact that he is a newcomer to the Institute, Vest told the Inaugural Planning Committee that it was essential that his inauguration be "in the MIT tradition." Fortunately, said Committee Chair Claude Canizares, that gives the planners a lot of freedom. "The MIT tradition," quipped Canizares, who is head of the Center for Space Research, "is not to be too bound by tradition."

Vest also instructed the committee to structure events that focus not on one individual but on the whole MIT community, events that celebrate "the continuity of the Institute as it moves from its very distinguished past into a rather uncertain future." He wants the inauguration to be an occasion that "will help us be a bit introspective about our own nature and also extrospective regarding the role we may play in shaping the future."

The inaugural week begins on Saturday, May 4, with the second Johnson Games and an Inaugural Picnic, which will bring students, faculty, and staff together. On Thursday, May 9, the MIT Symphony, Chamber Chorus, Festival Jazz Ensemble, and artists in residence will present a gala concert in Kresge, featuring a composition for voice and piano by Yumi Oshina, '94.

The actual inauguration begins with a 9:30 am procession that will wind from 77 Massachusetts Avenue to Killian Court to the strains of fanfares composed for the occasion by John Harbison, Peter Child, Edward Cohen, and Evan Ziporyn, all members of the MIT music faculty. Tickets for the Killian Court ceremony are available from the Information Center, (617) 253-4795. Following the ceremony there will be a community reception on the Kresge Oval. A Pres-



idential Ball will be given in the fall.

Framing this fun and pageantry will be the intellectual inaugural events. First is a spring symposium looking at engineering education and at the past and future relationships among research

universities, the federal government, and industry. The symposium will be held in conjunction with the centennial of the birth of Vannevar Bush, '16. A fall symposium will consider the role of the research university in a global context. Also in the fall, a Campus Colloquium will focus on the partnership between education and research. Professor Kenneth Manning, head of the Writing Program, is planning a book of collected writings growing out of these inaugural events.

Canizares explained that the Campus Colloquium program, while it does bring in guest speakers, traditionally emphasizes the discussions among MIT students, faculty, and interested alumni/ae. The symposia, on the other hand, will bring to campus some of the world's leading thinkers on these topics.

By framing the issues in terms of research universities in general, MIT—the "quintessential research university"—can define its own role while serving much broader interests, Canizares said.

"The appeal this job [chair of the inaugural committee] had for me," Canizares observed, "is that during the long search for a new president, I learned that many people around MIT are thinking about these large issues that involve the Institute, the country, and the world, but they often aren't talking to each other. People are touching different parts of the elephant, making it hard to come up with answers." Canizares sees the inaugural year as a chance to make members of the community more aware of each other—to cash in, so to speak, on some heretofore unrealized benefits of intellectual cross-fertilization. □



CLASS NOTES

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I am grateful to **Herb Lerner** for a newsy letter. He writes from Easton, Md.: "I am sorry to hear that Selma is in a wheelchair, but you both are indeed lucky to be where you are; God has been good to you both. I, too, have been at a retirement colony, William Hill Manor, for over four years now. I came here because my daughter, Sally, and her husband have a place on one of the waterway tributaries to Chesapeake Bay a few miles from here. As you know, I've been widowed twice, so I live alone in one of the cottages here. I have a big bedroom, bath, living room, and a full kitchen, the dining area of which I use for an office. The office is not like the one I had in New York for so many years, but it's a place to work and remind me of the days gone by. I still have some business connections where I act in sort of an advisory capacity, which reminds me of something Emerson wrote, 'Age gives good advice when it can no longer set a bad example.'"

"I get around a bit. Over Thanksgiving I celebrated my 97th birthday in Palm Beach as the guest of my other daughter, Adelaide. There's a lot going on here to amuse and entertain the people on the reservation, as I call it, but most of it is beyond my interest. I play a lot of bridge and some poker with a group with whom I feel comfortable. I read and study a lot and go to town on the bus a couple of times a week just to stretch my neck looking at the tall, two-story buildings. I get my own breakfast, sometimes lunch if I feel so inclined and take dinners at the dining room in the so-called Manor House."

Herb also reports that at least one other MIT man lives at William Hill Manor—Walter Edel, '39, who is known for his interest in repairing clocks, for free of course, and his kindness in doing that.

I record with sorrow the death of Mrs. **Granville Smith** of Sarasota, Fla.—**Max Seltzer**, 865 Central Ave., Needham, MA 02192

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I have a neighbor in his late 80s, and every time we meet he asks me if I am aware of the world population growth. I plan to send him a copy of the February 1991 *Review* so he can read the article, "Population Politics."

I spoke by telephone with **Doc Flynn**. He is 93 years old and sounds in good health. His wife, Erma, is also doing very well. Both of them are lovely people and so nice to talk to. . . . When I last talked with **Don Way**, our worthy class president, he was recovering from the flu. His wife, Barbara, is playing bridge these days.

Kindest regards to all classmates. Keep our next reunion in mind.—**Bill Langille**, secretary, P.O. Box 144, Gladstone, NJ 07934, (201) 234-0690

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Please send news for this column to: **Harold Bugbee**, secretary, #313 Country Club Heights, Woburn, MA 01801



Did You Know This Man?

Vladimir Dixon, '21 earned an engineering degree from MIT, followed by a master's in engineering from Harvard. He then went to work for the Singer Co. Based at the company's European headquarters in Paris, Dixon made something of a name for himself as a poet and a correspondent with such leading literary figures as James Joyce and Ezra Pound. He died at 29 but left papers that will be the focus of an edition of the *James Joyce Quarterly*.

John Dixon, Vladimir's son, is writing the introductory biographical essay for the quarterly. He would like to hear from anyone who knew Vladimir and has remembrances of him. Dixon's address is: 3537 R St., NW, Washington, DC 20007-2327, telephone (202) 337-1470.

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70th Reunion

This will be the last issue of class notes prior to our 70th reunion. Five years ago, your secretary felt there would be no more class reunions, realizing that all of us would be in our 90s. But here it is 1991, and a few of the class including widows hope to attend. Maxine and **Cac Clarke** are planning to attend with their son and daughter-in-law and **Frank Whelan**, so 1921 will probably have a class table on Technology Day. Besides the luncheon, Cac is planning to attend Boston Pops, the memorial service in the MIT chapel, and the *Technology Review* sherry party. It all sounds like fun.—**Sumner Hayward**, secretary, Wellspring House E64, Washington Ave. Ext., Al-

bany, NY 12203; Samuel E. Lunden, assistant secretary, 6205 Via Colinita, Rancho Palos Verdes, CA 90274

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Now that all alumni/ae who have passed their 65th reunion are invitees of the Alumni/ae Association to the Technology Day luncheon in the Athletic Center, perhaps our class will have a better attendance than last year (when only two appeared). The luncheon meeting will provide many of us with our first opportunity to hear and meet our new president, Charles Vest. Since 26 of us live within 100 miles of Cambridge, a good turnout seems possible.

Charles "Bill" Willis Stose died October 6, 1990, in Ormand Beach, Fla. After receiving bachelor's and master's degrees in chemical engineering, he joined Atlantic Refining Co. (now Atlantic Richfield). He spent his entire career with Atlantic, retiring in 1965, rising to the position of general manager of both the Philadelphia and Port Arthur, Tex., refineries. He is survived by a son, Willis G. Stose of Daytona Beach, Fla., a daughter, Gwen Stose of Silver Springs, Md., and seven grandchildren. . . . **Gilbert M. Fox, Jr.** (date of death unknown), who received a degree in electrical engineering, was continuously with the New England Telephone Co. until retirement in the 60s. He is survived by his wife of 60 years, Janette (Reid) Fox, a brother, Walter, and five nieces and nephews.

The class extends its condolences to the families of these able and respected classmates.—**Yardley Chittick**, secretary, Rt. 1, Box 390, Ossipee, NH 03864

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Technology Day this year will be Friday, June 7, 1991. Registration information can be obtained by contacting the MIT Alumni/ae Association, (617) 253-8230. An enlightening program has been planned on the subject, "Sex, Drugs, Genes, and Obesity—The Impact of Molecular Biology on Your Health." Four MIT professors will speak. How about it, fellows, obesity might be a good subject of interest. A fifth panel will be led by Professor Phillip Sharp, director of the MIT Center for Cancer Center. Let's make a showing in attendance.

Your secretary received a letter from **Atherton Hastings** early in January. He graduated in physics and was a member of several clubs while at the Institute. He married Alice Moore of Athens, Pa., and they have one daughter and two grandchildren. After MIT, he worked in Russia for two years setting up ammonia plants. His next experience was project manager of conservation work on a South Dakota Indian reservation. Following this, for 20 years he was with the Tennessee Valley Authority as a chemical engineer in their Office of Agricultural and Chemical Development. He has had many hobbies and local interests. Atherton and Alice live in Florence, Ala., and enjoy the mild weather. After retirement, he developed a landfill gas system in cooperation with Monsanto Chemical Co., that, after nine years of putting gas into the system, is

The Last "Knight of the Air"

By Joe Dwinell



In an age when a wartime adversary is a blip on a computer screen, Arthur Raymond Brooks, '17, still recalls seeing the beard of a German flying ace from the cockpit of his biplane. "I was trying to ram him," Brooks said. "He was a splendid young man and he dodged me."

The American ace and his German counterpart were locked in a dogfight over the French countryside during World War I. Brooks, diving through the clouds in his Spad XIII biplane, with its machine gun destroyed, eluded the German attacking in a Fokker D-7 biplane. "Don't ask me how, but I dove and got away," said Brooks, speaking as though he had just crash-landed his bullet-riddled aircraft. "I call it my guardian angel."

For the past 95 years, Brooks' "guardian angel" has watched over him from the sorties over France to his years fighting blindness and the infirmities of old age. He never planned on being a living legend: "I never tried to plan this or that, I just did it," he added.

Brooks, a Framingham, Mass., native, now lives in Summit, N.J., and says he misses his old flying buddies. But with his place in history have come "hundreds of new friends."

According to Ward Boyce, executive director of the American Fighter Aces

Association in Mesa, Ariz., Brooks earned his ace title by shooting down six German Fokkers during the war. To be designated an ace, a pilot must tally five or more confirmed "kills." There have been 1,450 American aces—just one percent of all the pilots from World War I to the Vietnam War.

Boyce, a good friend of Brooks, said he marvels at the World War I aces who flew in wood-and-fabric biplanes and triple-winged planes that "went up in flames" from just one bullet. The pilots did not have parachutes. "They were really the original knights of the air," Boyce added.

From the first time he went into battle in the summer of 1918, Brooks said he knew he was part of a revolution in the way wars would be fought. His biplane was a prelude to the B-17 "flying fortresses" of World War II and the modern fighter jets and stealth bombers. Even while flying in an open cockpit with the wind whipping in his face, Brooks believed a major part of future wars would be won and lost in the air.

"I personally knew when I was at the front, we were building what I called an air force," Brooks said. "Every chance I had, I went to bombing outfits, observation outfits, and British nightflight operations."

When Orville and Wilbur Wright

made the world's first flight in an airplane on December 17, 1903, at Kitty Hawk, N.C., Brooks said his future flew along with them. "It is normal and natural for me to fly, like I never stopped flying since the day I was born," Brooks said. "It's as natural as breathing."

He shared the limelight with fellow American aces Eddie Rickenbacker and Billy Mitchell and Germany's infamous "Red Baron," Manfred von Richthofen, who shot down 80 Allied aircraft before his death. "I'm the only chicken left to carry on," said Brooks. "I'm taking the trouble to include aviation history in my talks to young boys and girls." His Spad XIII biplane has been restored and is on display at the Smithsonian National Air and Space Museum, alongside Apollo spacecrafts and the Wright brothers' plane.

Brooks—who invites just about everybody he meets to his 100th birthday party—has been offered a gravesite in Arlington National Cemetery in Washington. But Framingham will be his final resting place. "I've always had it in my heart to be buried in my hometown," he said. "I'll be buried there unless I die in an airplane." □

The author is a staff writer for the Middlesex News, in Framingham, Mass., where a longer version of this article first appeared.

still operating. Another project consisted of a domestic gas generator for India, using manure to produce methane for cooking and heating. Also, working for Vita, he designed an improved donkey cart for Ecuador. He became very interested in Latin American relations and concerned about the exploitation of labor and resources for the multi-national corporations. Recently, he writes, the U.S. government, in collaboration with military dominated Central America, has caused many casualties, destruction of schools, clinics, and cooperatives. Dedicated U.S. doctors, ecologists, and scientists have alleviated some of the conditions. A very interesting letter, Atherton.

We have been informed of the death of **Marion E. Warner** in July 1989. She lived at 35 Depot Rd., Uncasville, Conn., and was married to H. Birney Hovey. She received a master's from Wellesley College and studied at MIT in Course V, later becoming a chemist for the U.S. Bureau of Mines, Salt Lake City, Utah, at some time in her life.—**Frederick O.A. Almquist**, secretary, 63 Wells Farm Dr., Wethersfield, CT 06109, (203) 563-4347

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I am twice blessed. I have received two long letters from classmates this last month. . . . A handwritten informative one from **Phil Blanchard** in Florida says: "You might inform the classmates that this may be their last chance to contribute to the Campaign of the Future. A direct gift to the MIT Alumni/ae Association would be credited to the campaign and to our class gift to MIT at our upcoming 70th reunion. It would result in a 100 percent income tax write-off. Investments in the Compton Trust would also be counted in the same way, and a gift write-off would be allowed on your income tax. You would be insured of a good income for the life of the trust. After which the money plus any appreciation would go to Tech as a gift." Thank you Phil. It certainly sounds like a sound investment.

My other blessing was a long letter from **Dick Shea**. He notes how proud the class should be in their performance "in regard to gifts to MIT, although improvement is always nice! Phil Blanchard has done a splendid job for us as class agent. Keep it up, Phil!" Dick also reminds us that he is still proposing that we compile a listing of living members of the class, with statistics regarding health, marital status, offspring, retirement activities, hobbies, etc. Information should be sent to him at 6501 17th Ave. West, Apt. 1105, Bradenton, FL 34209.

A note from **Don Moore's** daughter, Sandra Faber, thanks class members for the donations to MIT in memory of her father, but says any personal notes should be sent to her at 16321 Ridge Ave., Monte Sereno, CA 95030, as her mother died several years ago.—Co-secretaries: **Katty Hereford**, No. 237, Box 5297, Carmel, CA 93921; **Col. I. Henry Stern**, 2840 S. Ocean, No. 514, Palm Beach, FL 33480

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There will be no class reunion activities this year, but we hope a number of classmates will make Technology Day in June. The Biology Department will present a program entitled *Sex, Drugs, Genes, and Obesity—The Impact of Molecular Biology on Your Health*. For more information, you should contact the Alumni/ae office, (617) 253-8230.

By the time you see these notes, Margaret and **Courtenay Worthington** will have returned from their winter vacation on the beautiful island, Antigua.

Belatedly the news of the passing of **Gilbert B. Fletcher, Jr.** has reached us. He died on October 31, 1988. Gil worked for many years as a safety consultant for Employers Mutual of Wasau and

was located in various towns in Virginia. At the time of his death, Gil was in New York City.—**F. Leroy "Doc" Foster**, secretary, 434 Old Comers Rd., P.O. Box 331, No. Chatham, MA 02650

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65th Reunion

The January *Tech Review* report of our retiring president, Paul Gray, is worth reading. Included there is an outline of changes taking place. Paul will be taking over as chairman of the MIT Corporation from David Saxon, '41. . . . The Emma Rogers Society has been inaugurated. It is an association of women whose husbands were alumni or faculty of MIT, and membership is free and automatic. (See "Alumnus," this issue or call Betsy Millard, (617)253-8059 for more information.)

Theodore C. Muller of Westport, Conn., left us November 20, 1990. He leaves his wife, Helen, and two sons. As an architect he specialized in interior design and church architecture. . . .

George A. West of South Dartmouth died November 17, 1990, leaving a son and three daughters. He was an industrial engineer and assistant manager of services at Ernst & Ernst. . . .

Henry W. Jones of Philadelphia, Pa., died April 23, 1990, leaving his wife Pauline, his son, daughter, sister, two step-sons and four grandchildren. He was a former vice-president of Atlantic Richfield of Philadelphia. He was one of the first Sloan Fellows at MIT, 1931-32, traveled extensively, and was very active on a number of boards of directors of charitable and educational organizations. . . .

Louis R. Taylor of Bethlehem, Pa., has invited daughter Muriel and son-in-law Alan W. Pense, provost at Lehigh University, to accompany him and his wife to the class of '26 reunion. The Taylors will be celebrating their 62nd wedding anniversary. . . . **Thomas D. Green** of West Hartford, Conn., writes: "Keeping constantly occupied, between naps, coping inadequately with the doubts and dilemmas besetting a senile citizen. Which way is the door?" . . . A note of condolence came to your secretary from **John H. Wills** of St. Petersburg Beach, Fla. . . . Professor **Chia Yang Shih** of Beijing enclosed in his Xmas card a photograph of a Panda in the Beijing Zoo, which I have under my light on my desk.

You should have received your letter from **Bob Dawes**, our class president, about the June 6 Pops Concert and the June 7 Technology Day program, which looks excellent. The title of the program is "Sex, Drugs, Genes and Obesity—The Impact of Molecular Biology on Your Health." This program has been planned by the biology department to highlight the exciting research being done at MIT in molecular biology. Don't miss it. Saturday, June 8 may have more for Class of 1926, and, if not, the Cardinal and Gray plans for the day will be excellent. If you wish to inquire about or support ideas, write to **Bob Dawes**, or call him at (508) 562-6846.—**Donald S. Cunningham**, secretary, Eventide, 215 Adams St., Quincy, MA 02169, (617) 328-1840

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We regret to report the death of a true scientist in our class, who was previously on the faculty at MIT. **John P. Vinti** died on September 27, 1990, in Boston. He received his ScD in physics at MIT in 1932. He became a research physicist at Aberdeen Proving Ground, 1941-57, and at the National Bureau of Standards, 1957-65. He was professor of celestial mechanics at Georgetown University while at NBS. His special field was the dynamics of satellite orbits. He was selected as associate professor at MIT in 1969 in the Department of Aero Astronautics and later at the Measurements Systems Lab. John was a fellow of several scientific societies, of the International Astronautical Union, and was on the editorial board of the *Journal of Celestial Mechanics*.

Francis L. Burke of St. Petersburg, Fla., died on July 2, 1990. In 1928, he started with Western

Electric Co. in the Planning Department and was chief of job evaluation. In 1947, in Tokyo, he assisted General MacArthur with recommendations to step up production in communication plants in Japan. After retiring from Western Electric in 1966, Francis became an avid traveler, and, being unmarried, during the next years he traveled to all parts of the world.—**Joseph C. Burley**, secretary, 1 Harbourside Dr., Delray Beach, FL 33483; **Lawrence B. Grew**, assistant secretary, 21 Yowago Ave., Branford, CT 06405

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At our rung on the ladder of life, much of the class news concerns personal and classmate losses. That of **Walter Smith** has brought great attention centered on his contributions to MIT and the Class of 1928.

To be noted this issue is the death of **James J. Nargis** on October 1, 1990, after a career as architect of churches and hospitals in the Fresno, Calif., area. Also of **M. Mailous Coren** who died November 16, 1989, in Eastchester, N.Y. . . . A message from **Lawrence Glassman** discloses the death of his wife of 48 years, Ellen, on April 8, 1990, after a lifetime as a teacher, artist, and lecturer at the National Museum of American Art, and as an active participant in many of our reunions. We offer our condolences to the families of these members of our class family.

In a message from Roy Hopgood, '38, we have interesting comments on a Quarter-Century Club cruise on the Danube through Austria and Turkey in May 1990 on which Florence and **Walter Smith** arranged an MIT gathering of 38 of the travelers from various courses and which included Frances (Mrs. **James**) **Donovan**. Many of our class, including Ellen and **Lawrence Glassman** mentioned above and your secretary, have enjoyed notable worldwide travels that have enhanced their lives. . . . A letter from **James M. Farnum** reports that, though handicapped by vision problems, he still meets regularly with other retiree friends.

With the countdown to our 65th reunion under way, a quick appraisal of the vital statistics of our class may stir up interest. Our *Freshman Gray Book* in 1924 included 569 in list and section pictures, with one girl member. The 1928 *Technique* pictured 512 in the Senior Portfolio with 10 women, while its directory listing for '28 numbered 570 with 10 women. No current number of living members is at hand, but the list of known addresses used in the 50th reunion book, updated by **Walter Smith** and being continued as a function of the secretary, indicates 225 out of the 447 originally listed there, but of course there have been further unreported losses. Remembering the heavy attrition during our undergraduate years, rationalizing these totals requires some cogitation. An attempt will be made through the Alumni Office and your class agent, **George Palo**, to develop a corrected list for planning our last round-up.—**Ernest H. Knight**, secretary, Box 98, Raymond, ME 04071

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Edward C. Roche and his wife, Dorothy, write from their new address in Springfield, Va., to thank me for the birthday card. Last May, Edward fell and broke a hip, which had to be replaced. After a two months' hospital stay, he had to use a walker and a cane to get around. Full rehab takes about 10 months to a year. Dorothy also broke her hip while he was in the hospital, but hers did not have to be replaced.

From Kay and **Paul S. Baker's** Christmas letter: "We drove up to Sudbury in early May so Paul could attend his 65th Thayer Academy Alumni Day. Then the task of getting out the essay, 'Mankind's Problem,' into August and beyond. Things kind of rocked along into September when it was time to set up for raptor banding at

Cape Charles. In November, Kay had a 10-day hospital stay for fluid retention and later Paul was in for a brief stay for a bladder stone. December was for recuperation."

Just before we left for Florida, **Jerry Gardner**, our current class president, his wife (Ellie), and our secretary and his wife (Helen) attended a memorial service in the MIT Chapel for **Herman P. Meissner**, whose death was reported in February/March issue. The chapel was filled to capacity with friends and colleagues. Speakers included Professor Robert A. Brown, Department of Chemical Engineering; Professor Jefferson W. Tester, MIT Energy Lab; and Professor Clark K. Colton, Department of Chemical Engineering. At the reception in the Stratton Student Center with over 100 guests attending, we met Dorothy and her daughter-in-law, who happen to live on the Winchester side of Hutchinson Rd., just a few hundred feet of your secretary's home.

From last December, your secretary and wife Helen have some very bad news and some very good news to report. Helen developed pulmonary pneumonia, for which she was kept in the hospital for three days, cured, and discharged. On the way home, a van going at a fast speed hit our heavy 1990 Cadillac on the front passenger side with such force that our car was a total wreck. Helen suffered two ribs, one finger, an ankle, and pelvis broken. I was thrown from the front to the back seat, with minor cuts and bruises. It was a miracle that Helen survived. She, returned to the same hospital for 12 days (three in the ICU) followed by four weeks in a rehabilitation facility. God saved her life, for which I will be forever thankful. The good thing that happened in the same month was the birth of our first great grandchild, a girl. This makes four generations of females—my wife Helen, our daughter Linda, granddaughter Deborah Lee, and newborn Rebecca Elizabeth.

I regret to inform you of the passing of the following members of our class: **Charles Clarke Keeley**, Los Angeles, Calif., August 14, 1990; **Mrs. Doris J. Derbyshire**, New York, N.Y., November 4, 1990; **Robert T. Flaherty**, Waltham, Mass., December 5, 1990; and **Mary Ann Crawford**, Chicago, Ill., December 19, 1990.

Robert Flaherty was a marine engineer who worked for Crandall Dry Dock Engineering Co. for 39 years until his retirement in 1977. He was a member of Hovey Players of Waltham and Waltham Historical Society. He is survived by his wife, Emily, a son Robert Jr., and a daughter, Judith.

Mrs. Derbyshire was a longtime practicing architect in the New York City area. She is survived by a daughter, Mrs. Joy Hazel of Clark Island, three sons, and three grandchildren.

Mary Ann Crawford, 87, a longtime Chicago architect, received considerable attention for her designs in the last decade, including three exhibits of her drawings. "We are very proud she managed to become an independent architect during the period she did," said her niece, Alexandra Mitchell. "It was not easy for a woman even to maintain a business by herself then." Some of her early drawings, made while she was a student, were subsequently discovered and highly acclaimed. They were done in the Beaux Arts style of 19th century France. Her work was first shown in 1978 at the Artemisia Gallery as part of a Chicago women architects' exhibition.—**Karnig S. Dinjian**, secretary, P. O. Box 83, Arlington, MA 02174

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The December 1990 report on the Campaign for the Future included a photograph of the four 1990 recipients of the Bronze Beaver award and noted that **Jack Latham** was one of the four alumni thus honored. Jack's Christmas letter also contained a number of items of interest. In November Jack attended a joint meeting of the American Association of Blood Banks and the In-

ternational Society of Blood Transfusion in Los Angeles, a meeting attended by more than 8,000. Haemonetics, the blood-processing equipment company that Jack founded some years ago, was well represented by the 92 people they sent to this meeting. Jack is still doing research on novel designs of blood-cell separating equipment at a laboratory at Haemonetics, where he spends four mornings a week and has a small group of assistants. On the downbeat side, his letter brings the sad news that Ruth's health has deteriorated to such an extent that it has been necessary for her to go to Sherrill House, a nursing home near the Latham's home, where she receives excellent professional care in a well-equipped establishment."

From Hilton Head Island we have a card from **Dave Houston** lyrically describing his retirement home as having "extra fine climate, environment and, people, thousands of 80-90-foot pine trees, 22 golf courses, and more than 100 tennis courts." Dave's golf club is limited to 250 members and so he never needs to reserve a starting time. . . .

Winslow Hartford, professor emeritus of environmental science, continues to write extensively on environmental problems. He sent me copies of a number of his recent papers on this subject, numbered as high as "Publication 346," papers that are difficult to summarize briefly. As I understand it, his principal thesis is that science has now been politicized to the point where politically popular environmental programs are extensively funded, whereas environmentally more important, but politically unpopular programs are underfunded. For example, legislation requiring installation of costly scrubbers at midwestern power plants has widespread popular support, although the oxidation of biogenically produced sulfur by oxidants in automobile exhausts is a more serious problem. Programs designed to discourage the use of petroleum products, e.g., a high gasoline tax, are scientifically sound but unpopular. Similarly programs to spend large sums to remove asbestos insulation from school buildings are popular, although scientific evidence indicates that undisturbed asbestos presents a minimal hazard. I admire Win's missionary spirit, but suspect that changing the popular and media mind-set on these issues will be pretty difficult.

We have at hand a report from Natalie Sherman, **Jack Jarosh's** daughter, saying that Jack is now confined to a wheelchair at a Long Beach, Calif., rest home, but is apparently still mentally alert, enjoys reading, and "always wins at bingo games." He would like to hear from classmates, who may write c/o Natalie to 825 Oceanside Ave., Wilmington, Calif. . . . As previously reported, **Sig Linderth** is professor emeritus of the Duke University School of Engineering, and after his retirement remained active as a mechanical design consultant. In his recent report he notes that eye problems have made it necessary for him to stop driving, but he still enjoys repairing and restoring clocks (antique and other), following the stock market on his computer, and playing golf.

Diana Strange, associate director of the Alumni/ae Association, has asked the class secretaries to call their classmates attention to the fact that the Technology Day Committee has arranged an exceptionally interesting program for this year's Tech Day, Friday, June 7. The title of the program is "Sex, Drugs, Genes, and Obesity—The Impact of Molecular Biology on Your Health." The program has been planned by the biology department to highlight the exciting research being done at MIT in molecular biology. Interested alumni can obtain further information from the Reunions Office, (617) 253-8230.

Those attending the 60th reunion last June will recall that **Louise Hall** was among those who attended. We have now received word that Louise died in Durham, N.C., last December 16. Louise was professor emerita of Duke University, where she taught for many years in the Department of Fine Arts, which she originally organized, as well as in the Department of Architecture. In addition to an SB in architecture from MIT, she received

an undergraduate BA degree from Wellesley in 1927, a brevet from the University of Paris, and a doctorate from Harvard. She also taught at North Carolina State University as an adjunct professor. From 1964 to 1971 she served as Duke's representative at archeological excavations made at Winchester, England. I still remember the enthusiasm with which, at our 50th reunion, she described this interlude in her teaching. Louise published numerous articles on early American architecture and most recently contributed a chapter to *Architecture: A Place for Women*, published by the Smithsonian. She was a member of Phi Beta Kappa, the American Institute of Architects, the Society of Architectural Historians, the Historical Society of North Carolina, the Society of Mayflower Descendants, and the Historic Preservation Society of Durham. Also important from my standpoint, she was an assistant class secretary for a number of years.—**Gordon K. Lister**, secretary, 294-B Heritage Village, Southbury, CT 06488

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60th Reunion

This is a memorable year for our class—our 60th reunion—and I am sure those of us who can, will be there. The program is really tremendous, and by now, you should have received a complete list of all the activities including annual Alumni Luncheon on Technology Day, June 7. There they will announce the results of the generosity of our class as well as others. The figures are always astonishing—but needed in these years, particularly for scholarships, considering the cost of education today as opposed to what it was 60 and more years ago.

In addition, it will give us a chance to meet MIT's new President Charles Vest, and to attend the morning program "Sex, Drugs, Genes and Obesity—The Impact of Molecular Biology on Your Health." Personally, I intend to be there in ample time to get a seat—something I did not do last year though I really wanted to hear the program.

The news from you, my classmates, is small; and mostly from those who will not make the reunion.

First I had a note from Helen Worden, the wife of Edwin, our longtime secretary. Unfortunately he took a turn for the worse and is now back in the nursing home, Lake Eustis Health Care Center, Eustis, Fla. and is not doing too well.

Philip Walley Bourne, formerly of Bedford, who like myself entered with the Class of '30, a retired Boston architect, died of Alzheimer's disease December 19, 1990, at Sherrill House, a nursing home in Jamaica Plain. He had served as project planner for U.S. Housing Authority, Washington, D.C.; as regional planner for the Federal Housing Authority in Boston, as an advisor to the Hawaii Housing Authority, a housing consultant to the Republic of Haiti, and the U.S. State Department before he opened his own practice in Boston. His most recent work included projects at the Peabody Museum, the Salem Savings Bank, the G.M. Jones Memorial Library in Salem, and the Concord Public Library. He also served as chairman of the Massachusetts Art Commission from 1965 to 1977 and a member of the Massachusetts Designer Review Board in 1965-66; and as President of the Boston Society of Architects 1964-65. He is survived by his wife Mary Elliot (Nicholson), two children, seven grandchildren and three great-grandchildren.

John Fleisher, of Flemington, N.J., has advised of the death of **Willis Fleisher, Jr.** at his home in Winter Haven, Fla., on June 13, 1990. Willis was for many years with Mark Color and Chemical Co. of Irvington, N.J., serving as secretary and production manager. He was survived by his wife of 57 years, Mary, by two children, four grandchildren and two great-grandchildren. . . . Received a note from Vera P. Slack that "her beloved husband" **Thoresby (Ted) E. Slack** "passed away at home early Thanksgiving morning

(November 22, 1990) after a prolonged illness." Ted was only with us two years, but has been very loyal to the Institute since. He lived in Swansea, Mass., for many years where he was owner of Swansea Engineered Products. He served in the U.S. Navy from 1941 to 1945 where he was a Lt. Cmdr. By 1961 he had moved to Mango Isle, Fort Lauderdale, Fla., where he worked for the Broward County Board of Instruction, and remained there after he retired.

John Swanton reports that in mid-January he tried to call **Randy Binner** to tell him that he was going to meet with **Dick Ashenden** and the staff at the Alumni/ae office to go over our 60th reunion plans. He was sorry to learn from Hope that Randy had had a slight heart attack while they were away some days previous. Randy felt better at home, but suddenly worsened and was taken to the hospital. Late in January Randy had a quadruple bypass operation at Bridgeport Hospital, Conn. Hope said the surgery had gone well and reports of progress are encouraging. We all wish Randy a speedy recovery.—**Wyman P. Boynton**, secretary, 668 Middle St., Portsmouth, NH 03801

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Reunion chairman **Tom Weston** has gathered an excellent committee that insures an excellent 60th reunion. They include: **William Bannon**, **Wendell Bearce**, **Donald Brookfield**, **John Brown**, **Melvin Castleman**, **Albert Dietz**, **George Falk**, **John Flatley**, **Francis Gowen**, **Harry Johnson**, **Robert Minot**, **Ed McLaughlin**, **Douglas Miller**, **Albert O'Neill**, **William Pearce**, and **Charles Taylor**. You will receive reunion information from many sources. Plan ahead for our June 1992 get-together.

Ed McLaughlin writes that he and his wife, Polly, have been doing a lot of traveling—up the Amazon 1,000 miles to Manaus, cruised from Puerto Rico to Greece, visited Russia with MIT Quarter Century club.



Tom and Rose Weston

Tom Weston sends a year-end review of his activities for 1990. He describes a weekend celebration of his 80th with family and friends. Included was a tour of Boston, lunch at Boston Harbor Hotel, a trolley ride through north Middleborough, then a surprise dinner. Rose has retired after serving 21 years in the school department. Tom describes colorfully trips to Ohio, Kentucky, and Minnesota.

We have received the sad news that **Donald**

Whiston died in January at home after a brief illness. Don was our class treasurer for several years and our class president from 1972 to 1977. He worked closely with **G. "Bunny" Nealand** on many of our early reunions. Before retirement, Donald was deputy director for plant systems development at MIT, and he was responsible for the physical equipment and buildings of MIT. His wife, Betty, predeceased him. He is survived by two sons, a daughter, and three grandchildren. He will be missed by those of us who worked with him.

Irving N. Hilliard died in August 1990 after a long illness. For many years he was associated with Raytheon, Itel, and Trans Sonics. He was member of a team that developed the ball turret for fighter planes during World War II and a holder of several patents. He leaves his wife, two daughters, and three grandchildren.

Henry S. Duncan died in October 1990 after a short illness. He was an engineer for Otis Elevator Co. for 43 years. A widower of Mariem (Haspray), he leaves two daughters, a son, six grandchildren, and one great-grandchild. . . . We received information that **Eugene McBride** died in September 1990 after a short illness. When we receive more obituary information we will pass it on. . . . **Warren S. Little** died in November 1990. His wife, Ruth, had died in January 1990. Warren was the budget analyst for Raytheon until he retired in 1975. He leaves a son and two sisters.—**Melvin Castleman**, secretary, 163 Beach Bluff Ave., Swampscott, MA 01907

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Obits. **Frank Vanucci** died January 7, 1991. He was a World War II veteran—North Africa, 8AAF 93rd Bomb Group, retired as captain. He retired from Owens Corning Fiberglas International in 1976 after 43 years of service. He was active in church, Elks, Retired Officers of America, and Knights of Columbus. Mrs. Eva Vanucci lives at 52 Granville St., Newark, OH 43055. . . . **Roger Putney** died December 2, 1987 following a stroke in October. No other information is available. Mrs. Marjorie B. Putney lives at 22 Butternut Lane, Rockland, MA 02370.

The Alumni/ae Office advises of the following losses, dates unknown: **Raymond L. Brown**, 35 Tupelo Lane, RR #6, Brewster, MA 02631; **Joseph C. Gray**, 98 Fern Ave., RR 1, Amesbury, MA 01913; and **Harry Steinman**, 2633 Singing Woods Dr., Hillsboro, OR 97123.

Nice letter from **George Bentley**, Box 1051, Conway, NH 03818 to **Dick Fossett**. George is unable to attend the reunion but ponied up the \$25 for planning and expenses. He still operates a ham radio W1IQU, on the air since 1935! He looks forward with Alice to their 50th wedding anniversary next March. . . . Nice note from **John Longley** (1623 New Scotland Rd., Slingerlands, NY 12159) to **Burt Webster** sending him the class dues. He can't attend Tech Day this year, because of a reunion of fellow officers attached to the U.S. Embassy in London back in 1941, but they hope to make it in 1993. . . . **Mal Mayer** is active in SCORE as a counselor. He reports that they now handle about 2,000 cases a year. Nice write-up in the *Kennebec Journal*. . . . **Warren Daniels** and frau celebrated their 50th in September—Europe and a cruise through Norwegian fjords.

The administration wishes you to come to Technology Day Friday, June 7, 1991, to participate in a program entitled, "Sex Drugs, Genes, and Obesity—The Impact of Molecular Biology on Your Health." More information at (617) 253-8230. Be there!

Class dues are \$35 and are due to **LeBurton D. Webster**, treasurer, 297 Holden Wood Rd., Concord, MA 01742.

Your humble and aging secretary would be grateful if more of his classmates would communicate.—**William B. Klee**, secretary, Box 7725, Hilton Head Island, SC 29938, (803) 785-7746

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Please send news for this column to: **Robert Franklin**, secretary, P.O. Box 1147, Brewster, MA 02631; **George Bull**, assistant secretary, 4601 N. Park Ave., Chevy Chase, MD 20815

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Hal Everett writes, "Florence and I had most enjoyable visits with **Bernie Nelson** and with Sylvia and **Jack Hossfeld** on the Cape last July. Our traveling has been reduced but not stopped. I'm nearing completion of a manuscript showing 166 lives from myself to paternal immigrant ancestors 1620-1650." . . . **Arthur H. Cohen** writes from Lexington, Mass., "Still doing architectural design and commissions; traveling some: spent two weeks in Scottsdale, Ariz., this past winter, ten days in Portland, Oreg., a week in Short Hills, N.J., and a week on Nantucket. In June, went to our son's wedding in Montclair, N.J. Keep busy managing my industrial park in Woburn." . . . **Marjorie (Mrs. Bill) Parker** added a handwritten note on their Christmas letter from Bella Vista, Ariz.: "Hi. It is golfing weather here (60-70 degrees), but I've given up and Bill probably will wait till he has cataract surgery—lots of trouble distance-wise. It was fun reading in the May/June Review the article on nuclear plants and realizing our son of Monticello, Minn., and son-in-law at Yankee are working on that PLEX program for NRC. That's as near to fame as we get, so we claim every bit of it. **John Mooring** 'called' Bill via computer modems so they can now talk to each other. Son Tom talks to Bill via modems too."

The following comes from Phyllis and **Charles Debes'** Christmas letter. They celebrated their 50th anniversary at a surprise party March 2, 1990, hosted by their daughters and friends at the Hukilau in Key West. On July 9, Charles underwent a double bypass surgery following a heart attack on July 7. He was in the hospital and a nursing home until August 15. "It has been a long, slow road to recovery, but we feel he is steadily making progress."

The membership list of the MIT Club of San Diego lists two '35ers: **George Hatch** and **William Hawkes**. Your secretary was recently elected an elder and clerk of session at the Westminster Presbyterian Church in Escondido, where I sing in the choir. Beginning as a boy soprano at age 9 in the Episcopal Church in Swampscott, Mass., this is the 14th choral group with which I have sung. (That includes the MIT Chorus).

I regret having to report the deaths of two more classmates and a widow. **S. Trowbridge Leavitt** died June 20, 1990, in San Pedro, Calif., and is survived by his wife, Doris. . . . **Louis A. Young** died December 8, 1990, in Milton Mills, N.H., and is survived by two sisters, Mrs. Chandler Willey of Acton, Maine and Edna Auger of Lauder Hill, Fla. . . . Mrs. **Thomas P. Pitre** died in 1990 at Dunedin, Fla.

A reminder: Technology Day 1991 is Friday, June 7.—**Allan Q. Mowatt**, secretary, 715 N. Broadway #257, Escondido, CA 92025, (619) 432-6446

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55th Reunion

Connections, connections, connections! A call to **Rob Wead** in Hawaii got help in addressing a letter to Mrs. Lindbergh, but also an account of Rob's experience at the 1952 meeting of the Institute of Aeronautical Sciences. Charles Lindbergh was the principal speaker, and Rob was "so impressed with Lindy's saintly behavior that I was more conscious of my own behavior for several months thereafter." Rob is chairman of the Maui Council on Aging, and the County Department newspaper in December ran a 1933 picture of our freshman 150-pound crew captioned "Guess

Who? is the well known senior citizen" in the bow-or position. The reproduction is crystal-clear, and left to right **Wead** (bow), **Phillips**, **Bill Beckwith**, **Art Dolben**, **John Easton**, **Scott Rethorst**, **Al Whitcomb**, **Gordon Thomas** (stroke) and "Shorty" **Hubbard** (cox) come right off the page.

Then on a call to **Bob Boden** about the first issue of our 55th reunion directory (graduate students were omitted inadvertently) he reported a recent telephone conversation with **Mal Holcombe**, who had a heart attack in September. Mal said that the "replumbing" job is A-OK and, hopefully, relief from a lifelong heart problem. However, a staph infection developed from intravenous injections, and he had to keep his leg elevated for several weeks. Now, in late January Mal tells me that plastic surgeons worked on the incision, and were able to do without skin grafts. He is now walking a mile a day, but travel is pretty much limited to the seasonal back and forth to Hilton Head. He and wife Vivian were anticipating a visit there in February from **Ed Snow** and **Edith**. Mal's father Amasa, MIT '04, lived to age 89, and Mal sounds as though he might equal that. Cheers!

When I called **Harry Essley** in December concerning **Jim Baker's** stroke and paralysis, Betsy answered and gave me a number where I could reach Harry "at work." He later filled me in with a letter: "A couple of mornings a week a half dozen retirees who are good at and enjoy making things of wood, plastic, foam and naugahyde gather at a well-equipped workshop. We make one-of-a-kind type things for wheelchairs, trays, special cushions, entertainment devices for handicapped people and those recovering from strokes. . . . In the group are a former optical engineer, mechanical engineer, two dentists, a bank president, salesman and purchasing agent. One is MIT '44—Arnold Mackintosh." Harry and Betsy flew to Thailand in January 1990 to visit their daughter who was working in a refugee camp for Cambodians at the border. "We also had a chance to see the gorgeous temples and King of Siam palaces and ancient capital."

A Christmas card from **Charles Holman** and Lucy included a note: "both well and happy, but didn't get to New Mexico this year. I had a severe attack of shingles in the fall—had to withdraw from the skeet world championships, and it messed up our hunting season, but I'm mostly recovered now." . . . The **Lippitts'** annual newsletter tells of spending three weeks (instead of three days as planned) at Lake Thun in Ruth's homeland—Switzerland—while Henry recovered from a bout with pneumonia. Then two months at Wengen near Interlaken, and by rail and car through southern France with stops to see friends and a Lippitt cousin of the Austrian branch. Henry and Ruth celebrated his 76th birthday this January with a cruise around San Diego Bay on a motor launch built for his grandfather in 1919 at the famed Herreschoff Works in Rhode Island. I am beginning to believe that Henry at last has really retired.

Charlie Price called in January and put his wife Margaret on the phone. She is in a group of two dozen women opera buffs who travel to distant places, and this year it is the Santa Fe Opera. In the course of providing her with local information on climate (the opera is open air, but two-thirds roofed and with marvelous acoustics), hotels, etc., Charlie asked about **Phil Hart**. I had not seen Phil since lunch in downtown Santa Fe in 1988, but he responded at once, and Margaret may have hit a jackpot! Turns out that Phil has been on the Opera Board at various times over some 30 years, knows the director and assistant well, and he offered to help where he can. Phil was Course V for two years, but opted for the arts at Reed College, setting the stage for a long career in music (see July '88 Notes). His biography of Fritz Reiner is now completed and is in the hands of his agent to arrange publication.

To everyone we have visited in person or by telephone or letter these past five years: We hope to

see you at the 55th reunion for up-to-date reports. And especially we want to see the many others not yet reached. If I have the job of secretary another five years (a little electioneering here) I shall keep travelling, but there is still a lot of territory to cover, and perhaps not enough time. Please make a special effort.

Let's give a toast to the lives of **Frank Gregory**, **Fred House** and **John Sylvester**! **Frank** (Course X) died November 30 after two years of a congested heart condition, nursed at home by his wife Margaret. In World War II as a lieutenant in Army ordnance he worked with gas masks, adapting to the use of synthetic rubber. Then, after a number of years with Simplex Wire in Cambridge and a now defunct rubber manufacturer in Providence, he started a custom molding business in Rockport, Maine. With Margaret and a son assisting, he continued until his illness. She continues the residence in Rockland, ME 04841, RFT 1, Box 1516. **Ben Fogler** (Course X) is her brother. . . . A clipping from the *Sarasota* (Fla.) *Herald* tells of **Fred House's** death August 21. Fred lost his wife Elizabeth Walbridge in 1961. He married Elizabeth Dunham in 1963, but was again a widower in 1984. In our 50th reunion picture he is seated on the floor, eighth from left. Fred was Course X-B, and was with Badger Co. in Cambridge for 34 years, designing oil and chemical plants. In the years 1971-74 he did much camping in Europe, and later cruised around the world. . . . **John Sylvester's** death at Washington D.C. on July 26, 1990, was recorded in the *January Review*. The 1936 *Technique* lists him in Course II as a graduate student from the U.S. Navy, and in 1961 he was vice-admiral USN, Deputy Chief of Naval Operations at the Pentagon. He retired sometime before the 1975 Alumni Directory was printed.

A letter from **Bob Walker** tells of a leg artery bypass revision in March 1990 which failed; the subsequent amputation of his right foot, and the sudden nighttime death of Thelma in June of a hypodrychemia seizure. Bob is able to drive again (artificial limb and left foot); spent Thanksgiving with his son in Oklahoma and saw his grandson become an Eagle Scout, then had Christmas in Michigan with his daughter and family. "I've got to keep moving and it seems I have a number of destinations to visit. So, I'll see you at the reunion." In the 50th reunion picture, Thelma was third from right in the back row. **George Parkhurst**, a former neighbor in Chelmsford Mass., and **Phil Gilinson**, a member of the church she once attended, will remember her well. Our sympathy and admiration go out to you, Bob!

A booklet from the Institute entitled "In Memoriam" lists by Class year the names of alumni whose memories have been honored with gifts from others in the previous college year. Such gifts are a gracious and enduring way to honor our friends and loved ones. For 1989-90 our class has six honorees: **John Easton**, **Bill Garth**, **Paul Mulkern**, **Elliot Robinson**, **Eliot Sargent**, and **Norm White**. John and Bill have been memorialized with an endowed fund, and I know that **Jack Ayer** and **Bill's** widow Sally, respectively, are contributors.—**Frank L. Phillips**, secretary, 1105 Calle Catalina, Santa Fe, NM 87501, (505) 988-2745; **James F. Patterson**, assistant secretary, 170 Broadway, Pleasantville, NY 10570, (914) 769-4171

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Art Zimmerman writes, "On Saturday, October 20, 1990, Agnes and I had a most exciting experience. We had the opportunity to attend an open house held by Abanaki Corp. in celebration of its new facility. What was significant is that the corporation was started five years ago by our good friend and fellow classmate **Edwin L. Hobson, III**. 'Hobby' had had an interest in this business for some time but it wasn't going anywhere, and when his son Tom was graduated from Hobart, Hobby decided that the time was right to do something with this investment or get rid of

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it. He decided on the former. Tom has done a great job of building up and expanding the business, but it was obvious that his father's support, organizing ability, and dedication were big factors. They have a fine new, albeit small, facility in Bainbridge Township, and I was particularly impressed with the fact that they dedicated the building to the lady who came with the business when they started and has been a significant factor in their success to date. I would predict that this operation will continue to progress, and I think it is marvelous that one of our classmates should have entered into this venture at the age he did." Arthur continues, "For myself, the developments are more in the direction of tapering off. I am ending eight and a half years of a very rewarding association with the Cleveland Commission on Higher Education this week. Also, Agnes and I have sold our home and are 'downsizing' into an apartment. I haven't decided to completely abandon constructive pursuits and do have an active offer to become associated with a friend who has a sales consultant business. We shall see."

Ten years ago, **Horace B. Van Dorn** stepped down from 43 years of engineering and management responsibilities at the former Fafnir Bearing Co. located in New Britain, Co. Soon finding the mantle of retirement an uncomfortable fit, he went back to work as a volunteer counsellor with the Service Corps. of Retired Executives (SCORE). Not long after that, he began "part-time" employment as an economic development specialist at the New Britain Chamber of Commerce. In five years of cramming a full-time work-load into a "part-time" schedule, Horace has conducted more than 200 individual counseling sessions with budding entrepreneurs, helping them get a start-up business off the ground or improve operations of an existing enterprise. In addition to working with SCORE and the chamber, he also helped out through the Entrepreneurial Support Center at Central Connecticut State University. At the end of this month, Van Dorn is going to try retirement again. Well, sort of. Even as he prepares to leave, he has agreed to handle some special projects. "You might say Van is retiring, but it's more like he's freeing up his time for personal things, such as traveling or working on his golf game," said George S. Brzuszniak, the chamber's executive vice-president. Horace went to work in 1937 at Fafnir's. The world-famous maker of precision ball bearings was his only employer for 43 years. He obtained 21 patents on ways to make better bearings more efficiently, and assigned them all to his employer. His final title at Fafnir's was vice-president of engineering.

Received a note from **John Nugent**. In July 1990, he developed symptoms that his doctor diagnosed as a slight heart attack and spent five days at the Clifford Memorial in Vermont. But sophisticated tests showed no scar tissue, so he is up and around and feeling fine. In July 1989, John and his sister Mary took a wonderful Alaskan vacation aboard the *Rotterdam*.

The title of the program scheduled for Technology Day, June 7, 1991, is, "Sex, Drugs, Genes, and Obesity. The Impact of Molecular Biology on Your Health." This program has been planned by the biology department to highlight the exciting research being done at MIT in molecular biology. It should be an outstanding program and well worth your attendance.

It is with sadness I report the death of **John C. Gibbs** on May 11, 1989. Our condolences go to his wife, who resides at 3204 Skipsworth Dr., Las Vegas, NV 89107.—**Robert H. Thorson**, secretary, 66 Swan Rd., Winchester, MA 01890

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The earthshaking news this month is twofold: **John Glacken** and Frances are spending five months in Bradenton, Fla., and **Bruce Leslie** is compiling a genealogical study of his mother's fa-

mily for imminent publication. By coincidence your assistant secretary is working on a not-to-be-published study of his wife's family, the descendants of Joseph and Rebecca Leslie of Newbury, Vt. We haven't yet found any connection between Jean's Leslie and Bruce's Leslie. The **Hadleys** were honored by a persons-of-the-year article in the December 27 issue of our local paper, which mentioned, among their major accomplishments of sleeping and taking naps, several side issues such as driving for the other elderly, working in a nearby soup kitchen, helping others with their tax problems, and serving on the town council on aging and the area board for the volunteer-driving program.

Don't forget the Technology Day activities on June 7, followed by the annual class mini-reunion at Endicott House. The daytime program covers sex, drugs, genes and obesity; the Endicott House part covers food and alcohol and whatever sex and obesity you bring with you. If you're not on the list for the mini-reunion, write or call **Don Severance**, secretary, 39 Hampshire Rd., Wellesley Hills, MA 02181; or **Ed Hadley**, assistant secretary, 50 Spofford Rd., Boxford, MA 01921

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For information about Technology Day special events and programs for Friday, June 7, 1991, one can phone the Reunion Office, (617) 253-8230. Programs to be presented include "Sex, Drugs, Genes, and Obesity—The Impact of Molecular Biology on your Health."

About 200 widows of '39ers may like to know the Emma Rogers Society is a newly-formed organization at the Institute for widows of alumni who desire to continue to feel connected to and honored by the Institute. For more information contact Betsy Millard, manager, Emma Rogers Society, Room E38-202, MIT, (617) 253-8059.



Hewitt Phillips

Hewitt Phillips designed and built a gas-powered crimson and gray model monoplane. The wingspread is about five feet. He writes: "I retired from NASA Langley Research in Hampton, Va., but as a DRA (distinguished research associate) I can keep my office there and use the facilities. I keep busy on research projects that interest me, including pressure drag of airfoils and dynamics of aircraft in landing. Also, I enjoy building model airplanes. In December I gave a talk at the Langley monthly colloquium lecture series, entitled 'Recollections of Langley in the Forties.' This talk was kind of a 50th anniversary celebration for me because I started work there during July 1940. I am involved in two museum projects now: a team-built demonstration wind tunnel for the new Hampton, Va., Air and Space Center and the design of an exhibit on free flight for the Academy of Model Aeronautics Model Airplane Museum in Reston, Va." . . . **Art Vogeley** is retired and now lives in Yorktown, Va.

His son, also a graduate of MIT, founded a company called 'nVIEW. They make computer screen projection systems. Art helps by consulting.

On the subject of free flight, **George Cremer** was one of five persons in the basket suspended from a heated-gas balloon. In the basket, George and his companions flew freely for an hour at elevations up to 1,000 feet before landing safely north of Escondido, Calif. . . . **Jim Barton** and Nancy completed a tour to and through the Carlsbad Caverns of New Mexico.

I'll share a story with you '39ers. Imagine you are driving to a routine appointment with your family doctor. When you are about six blocks from his office, your wife says, "Hon, I feel a pain in my chest." Within the next 15 minutes, you and your wife are enroute to a nearby hospital where she is received and scheduled for a catheter probe that reveals two restricted arteries near her heart. Heart specialists recommend immediate bypass surgery.

This is what happened to Hilda and me 11 days ago. Now Hilda is home. The four-way bypass was successful, and she is convalescing nicely.

Probably most '39ers by now have reviewed and confirmed that their own wills and associated documents are neat and complete. However, if some have deferred that task, our story may stimulate you to update promptly. Thereby, some surviving spouses may be well served.—**Hal Seykota**, secretary, 1701 Wetherswood Dr., NW, Gig Harbor, WA 98335

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This year's Technology Day is scheduled for Friday, June 7, 1991. The program has been planned by the Biology Department to highlight the exciting research being done at MIT in molecular biology. Four outstanding professors will speak on, "Sex, Drugs, Genes, and Obesity—The Impact of Molecular Biology on Your Health." Later in the day, there will be panel discussions on the clinical and ethical issues raised by the research. It is not too early to start planning to be in Cambridge in June, even though it is not a reunion year for our class. For more information call (617) 253-8230.

Edgar Bernard sent me a note that a 1940 Scholarship Fund has been established. Class members may now designate this fund when making restricted contributions to the Alumni Fund.

Class treasurer **Richard Babish** writes that he has received payments for class dues from 137 classmates. Of these, 65 paid for more than one year, and 41 paid for the next five years. This certainly represents a lot of enthusiastic interest in the class by many of its members. Dick also received notes from several classmates.

Paul Bollerman would like to see a mini-reunion in the Southeast or in Florida in 1992, as well as the 55th in Newport. His comment on the 50th: "It was great—enjoyment, organization, program, but, above all, to see so many from years ago." . . . **Walter Brewer** doubts that he would make a February/March reunion in 1992, as skiing is too good at that time of year in the West. He would have a slight preference for the 55th to be in or around Cambridge. . . . **Ray Keyes** expresses his appreciation for all the work done by the committee on the 50th reunion. He enjoyed it immensely. He had surgery last August on his right shoulder, but it was not successful. This, added to a long time handicap of two legs from polio, has slowed him down considerably, but he still seems to be keeping up his spirits and making the best of it.

Walter Schuchard returned in December from a trip to Maui, Hawaii. On the way back, he stopped in El Cajon, Calif., to have lunch with **Elsie** and **William Schnorr**, where they had a great time. Bill inquired whether he could wear his red jacket in June when he attends his son's graduation. All of us are entitled to wear this

badge of our longevity at any and all Tech events.

Please send in your news so that there will be items of interest for classmates in future columns. I look forward to hearing from you.—**Richard E. Gladstone**, secretary, 1208 Greendale Ave., Needham, MA 02192, (617) 449-2421

41 50th Reunion

Our 50th reunion, our gala event, is taking place now. While this is being typed, our 50th Reunion Book is in the last stages of assembly. It will be sent to all who have contributed to the reunion. Should you wish to receive one of the few extra copies, please get in touch with your secretary.

Our famous treasurer, **Ivor Collins**, Chapel Hill, N.C., has sent many news items. . . . **J. Dodd** has moved from Litchfield, Conn. to 64075 E. Meander Dr., Tucson, AZ 85737-1049. . . . **Bill Bowes**, Capitano Beach, CA 92624, will attend the reunion.

Edward K. Owen, Lebanon, MO 65536, is not sure he can make it. . . . **Larry C. Turnock** calls his retirement difficult; it took almost two minutes to adjust to it.

Malcolm J. Abzug tells us belatedly of the death of one of our more adventurous classmates, **Raymond Ceasar Fernandez**. He died while skiing in Colorado in 1986. Fernandez was a naval aviator in World War II. He was a representative of the Air Research Division of Allied Signal Aerospace of Torrance, Calif. He joined Air Research in the early 1960s, serving in corporate sales in Madrid and in Geneva. Fernandez became head of propulsion in Navair. As executive officer of an early Phantom squadron, he had double engine failure and landed dead stick on a Long Island beach. In June 1980 he was seen gliding again, this time at the controls of a sailplane at Crystal Airport, Pearlblossom, Calif. A son, Anthony Ray Fernandez, also became a naval aviator.

Malcolm also heard from **Bill Lamar** that another World War II aviator, **John L. England**, died of a heart attack in June 1990. Jack did the statistically unlikely feat of flying 25 bombing missions with the Eighth Air Force without a scratch. Jack and Malcolm lived in a farmhouse east of Dayton when they worked at Wright Field in July 1941.

Elizabeth Guensey Wilson informs us of the death of **Glen A. Guensey** of cancer in Fayetteville, N.C. He leaves behind another daughter, Sara Baven, and a son, David Guensey. . . . **William V. Shyne** has retired. Bill lives in the Philippines.—**Joseph E. Dietzgen**, secretary, P.O. Box 790, Cotuit, MA 02635

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The big news this month is that our Reunion Committee led by **Jerry Coe** is off and running with plans for the best 50th reunion ever staged on the banks of the Charles. And it will be just that if all of you say "YES!" when Jerry asks you to help out with the festivities. We'll be back at the Woodstock Inn from June 1-3, then on campus for June 4-5. More next month.

Lou Rosenblum is on the lecture circuit talking about design of PostScript fonts for the electronic publishing community. . . . **Bill Seaton** retired from his position as CEO but remains chairman of the board of American President Companies in Oakland (Calif.). I had a pleasant phone conversation with **Lou Stouse** who retired from American Telephone and Telegraph in 1988 and spends a lot of time umpiring tournaments for the U.S. Lawn Tennis Association.

Two obits: **Russell Thompson**, retired from Exxon, died in Baton Rouge. **John O'Connor**, retired from the U.S. Department of Energy, died in Washington, DC. Our condolences to their families.—**Ken Rosett**, secretary, 191 Albemarle Rd., White Plains, NY 10605

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We have received obituary notices for **Maurice R. Evans**, Halifax, N.S., and **Leonard W. (Bill) Kates**, Providence, R.I. Unfortunately, for Maurice there is no information beyond the date of death: November 1990. . . . Bill Kates, former president of the United States Textile Co., Fall River, Mass., passed away last December 7. A native of Mineola, N.Y., he lived for many years in Fall River. After graduation he worked in the field of atomic energy, receiving numerous patents in electronics and metallurgy. Before his affiliation with U.S. Textile, he was director of engineering for Sylvania-Corning. He is survived by his wife Barbara, three children and five grandchildren. We extend our condolences to the family.

From San Diego comes news about former Colombian President **Virgilio Barco**. In November he received the Institute of the Americas Award for Democracy and Peace, being cited for his courage and tenacity in confronting Colombia's cocaine cartels. From 1977 to 1980, Virgilio served as Colombia's ambassador to the United States. He is now filling a similar appointment in the United Kingdom.

The newsletter *Civil Engineering at MIT* reports the retirement last fall of **William Pool**, who served the city of Phoenix for over 29 years as a civil engineering technician.

We have been reminded that Technology Day 1991 is scheduled for Friday, June 7. In addition to the usual T-Day activities, the Biology Department will put on a program titled "Sex, Drugs, Genes and Obesity—The Impact of Molecular Biology on Your Health." At our age and stage of life this may be of only academic interest.

By now you should have received preliminary reunion information, including the postcard showing the gathering spot at Wychmere Harbor. The Committee is doing a great job of preparation, with the 50th Reunion Book being put together by **Dick Feingold** and **Gil Edelman**.

The tension builds, anticipation rises. Can we hold on for two more years and build up the pot?—**Bob Rorschach**, secretary, 2544 S. Norfolk, Tulsa, OK 74114

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Jim Weaver retired ten years ago as vice-president of venture and capital appraisal of ICI Americas, Inc., and has spent much of his time since reading and analyzing books on the subject of capital investment appraisal. He is recognized as an international expert on capital investment and his monograph "Analysis of Textbooks on Capital Investment Appraisal" has recently been published by the American Association of Cost Engineers. His wife, Judy, had a brain tumor removed in 1989 and is still enjoying life but she is far from self-sufficient.

Technology Day, Friday, June 7, will feature a program called "Sex, Drugs, Genes and Obesity—The Impact of Molecular Biology on Your Health." The program has been planned by the biology department to highlight the exciting research being done at MIT in molecular biology. We hope to have a good turnout from '44.—Co-secretaries: **Andrew Corry**, P.O. Box 310, West Hyannisport, MA 02672; **Louis Demarkles**, 77 Circuit Ave., Hyannis, MA 02601

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As I write these notes that were due in Cambridge yesterday, Jean and Prexy Chris Boland are en route from Jackson, N.H., for dinner here in New Castle this evening. The Bolands have just completed their annual cross-country ski trip to Christmas Farm Inn in Jackson. If memory serves correctly (and it is beginning not to!), Chris and Jean regularly hit our winter thaw. It has been in

the fifties in the mountains for three days this past week.

A most interesting letter from **Jim Barrabee** in Brillion, Wisc. "Seems like many years have passed since I have written regarding my activities. Having changed class years so often during the war, it seems I have allegiance to three, with '45 being the final choice. I recently retired from Bullion Iron Works as manager of Quality Assurance, and decided to settle here with a new house and bride. This was my second retirement since I called it quits at International Harvester in 1981 and came here after a mere two-day weekend.

"Been playing a lot of golf, shoveling snow, and taking Vermont vacations whenever possible. Have been teaching class locally and will be lecturing for the American Foundrymen's Society this coming year. I also keep active in the American Society of Quality Control, which is most concerned with the country's quality image for the future. My daughter is a chef in Steamboat Springs, Colo., and my son is with the Red Cross in Indianapolis specializing in disaster relief."

Mary Trageser indicates that she has become interested and involved with the Emma Rogers Society, an association of women whose husbands were alumni or faculty at MIT; one might say that Mary was following in Dave's footsteps. Mary took her second trip to England last fall, her first being with Mary Hoagland in the fall of 1989. In 1990 Mary Hoagland's UK visit was a trip to England and Switzerland in August with son Chris. She also squeezed in a trip to Israel and Egypt in April, as well as Portugal in September. What else would one expect of a Wellesley girl! Between travels and ever-loving care for children and grandchildren, Mary stays busy evaluating mandated AIDS education in New Mexico public schools, fundraising, choir, church trustee, and, oh yes, tennis and aerobics to keep in shape!

The big event for Anne and **Bob Maglathlin** in 1990 was a right-hip replacement for Anne in late November. Reports from the battlefield indicate that Anne is more mobile than she has been in 20 years. Best you keep running, Robert! Bob is similar to most retirees—multi-year projects and too much time spent wondering when one should start! . . . Louise and **Tom McNamara** missed their first five-year reunion last June; their excuse was a conflict with a trip to the Northern Capitals of Europe—Bergen, Copenhagen, Stockholm, Helsinki, Leningrad, Moscow, Warsaw, and Berlin, as well as a number of lesser cities. Wow!

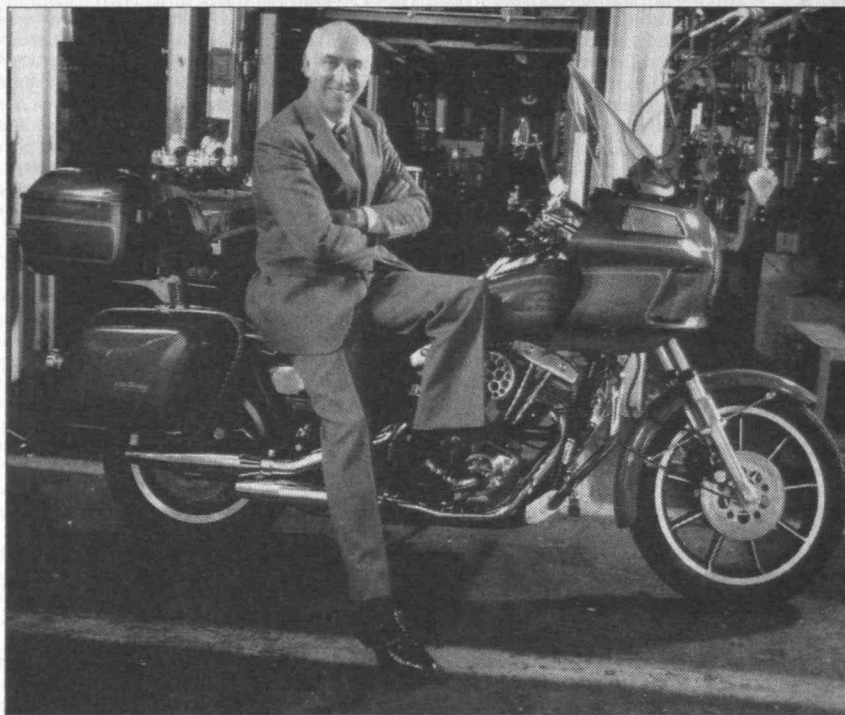
A Christmas note from Elaine and **Bill Shuman** indicates that they are still sailing out of Round Pound, Maine; we'll see you in Muscongus Bay this summer, Willie! . . . **Vince Butler's** Christmas card's return address was Room 619A, MIT V-12 Unit, Cambridge 39. How many of you old V-12ers can remember your room—or should I say, how could you forget! One of these days I'll fill these notes with V-12 regulations, courtesy of Captain V.K. Butler, Jr., USNR, retired. Vince also uses USNR cards!

Edna and **J.J. Strand** were at the Brandenburg Gate, Berlin, on October 3, 1990, which was Reunification Day in Germany.

Max Ruehrmund had a mild heart attack December 22, but all reports indicate that Max had a speedy recovery and is back to normal—and, oh yes, we must make note of the first grandchild, Max Ernst IV. Sounds like a new dynasty to me! Max, it was 38 years ago that we lived in Bryant Crescent, White Plains, N.Y.

None of us will ever catch up with Carol and **Nick Mumford** when it comes to grandchildren. As of the time you read these notes, the combined total should be 22. Any challenges? . . . Nick's old grad house roommate **Tom "Steve" Stephenson** indicates that he had a successful cataract operation in early December which he feels will improve his golf game. Jimmie and Steve divide their time between Naples, Fla., and Steve's hometown of Maryville, Tenn.

Barb and **George Bickford** continue to commute



To honor Vaughn Beals' ('48) contributions to Harley-Davidson's turnaround and to the American motorcycle industry, the company observed Vaughn's retirement by endowing an undergraduate scholarship in his name at MIT. Vaughn joined Harley-Davidson in 1975 when it was still owned by AMF. At that time, he observed stress symptoms—a strike and severe quality control problems—brought on by an earlier rapid expansion. Vaughn had so much confidence in the promise of his

long-range plans that he, along with a dozen other investors, purchased the company in 1981 and took it private. His main task during the first five years was to "rebuild the product" in line with customers' demands and suggestions. How did he achieve the turnaround? He says himself that he was sometimes autocratic and sometimes overly participatory. "But, overall, what I managed to do was build a team," he observes. He created an environment where others could succeed.

between their new farm in Cazenovia, N.Y., their Vermont retreat, skiing, tennis, and golf trips to exotic continental spots. Unfortunately, rainy weather haunts their trips to Massachusetts, for they were unable to play tennis during Phi Beta Epsilon's 100th anniversary party in Cambridge last September.

The success or failure of these notes rests upon you, so let's hear from you as today's society will not let me put together a completely fabricated set of notes as I did once upon a time long long ago!—**Clinton H. Springer**, secretary, P.O. Box 288, New Castle, NH 03854

46 45th Reunion

A couple of correspondents I overlooked in last month's (April) edition were: a) **Pauline (Glazer) Teague**, whose cards and letter indicate a peripatetic lifestyle, with junkets from her California home to Poly Poly Islands, Arizona, and trips "back East" and the San Francisco Bay area; and b) **Ken Davis**, our Manhattan mogul, who sent a nice Christmas card and an even nicer photo of him and wife Ellie sitting on their terrace overlooking Greenwich Village. Turns out Ken, another swim-team buddy, has embarked on a new investment banking company, financing and managing work for mid-sized companies, while

Ellie is assistant editor of *Family Circle* magazine. They're looking forward to an upbeat 1991, including attending the 45th. . . . Which reminds me to remind you, again, of the class's need for filling our empty coffer, depleted by numerous mailings, etc. We'd like to see some \$25 checks sent to MIT Class of 1946, c/o **Herb Oedel**, 166 Upham St., Melrose, MA 02176—**ASAP!**

From our alumni grapevine, we learn that **Earl Dionne** turned his collar around in the 1950s and was ordained a Catholic priest in 1958. He taught sciences for 22 years at St. Francis Seminary and St. Thomas More school in Milwaukee, where he still lives. He has also spent time as chaplain at the VA hospital and six different parishes as temporary administrator. He is currently awaiting a short-term pastoral assignment prior to next year's retirement.

An obit from the Alumni/ae Association tells of **Jerome Fischler**, a Course IX grad in the September class, who last worked at Douglas Aircraft's Long Beach plant. He is survived, as best we know, by niece **Beth Barovick**.—**Jim Ray**, secretary, 2520 S. Ivanhoe Pl., Denver, CO 80222

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Several items this month—let's go in alphabetical order. **Low Bernheim** writes from Short Hills,

N.J., to tell us he is *not* among those classmates with a missing address. Sorry, Lew. Somehow the system screwed up. Lew was at our 40th reunion and is looking forward to information about the 45th. . . . **Art Dershowitz** is retired in Fairfield, Conn. His wife, Hope, retired in September 1990. They have five grandchildren. They are certainly a loyal MIT family—two sons and one daughter-in-law are MIT graduates. Art recently wrote a bulletin on engineering demand for the Engineering Manpower Commission—he is an emeritus member. . . . **Tom Cummings** (one of my housemates at Student House for awhile) was honored with the Putnam Award for Excellence in Teaching during Founder's Day ceremonies at Bradley University. He went to Bradley in 1955 after earning his Ph.D., at Case University. He has taken sabbatical leaves at, among others, the Analytical Institute at the University of Vienna and the University of Birmingham, England. He has been a consultant for the Illinois EPA and a major chemical company, and is a member of many professional societies. Tom was described by a former student as having a "maverick" streak in him and seldom accepting conventional wisdom!"

Ken Marshall writes from St. Louis to tell us that the Senior Olympics have now become a member of the U.S. Olympic Committee as the U.S. National Senior Sports Organization. The senior group's biannual games are still called the Senior Olympics and will be held next in Syracuse in June 1991 and in Baton Rouge in 1993. Ken was the first president of the group and is still a director and chairman of the National Games Committee. There are now more than 80 affiliated annual senior games around the U.S.; winners of those games go to the nationals. Over 4,000 athletes are expected at this year's nationals.

The Alumni/ae Association has asked us to announce that Technology Day will be Friday, June 7 this year. The title of the Program is "Sex, Drugs, Genes and Obesity—The Impact of Molecular Biology on Your Health." There are several interesting speakers in the morning, then the Technology Day Luncheon and panel discussions in the afternoon. For more information, call the Reunions Office at (617) 253-8230.—**Robert E. McBride**, secretary, 1511 E. Northcrest Dr., Highlands Ranch, CO 80126

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The mailing about our September 27-28, 1991, Martha's Vineyard reunion was sent out in early February, and within a few days **Graham Sterling**, **Bill Katz**, **Norbert Andres**, **Gene Ashley** and **Dan Muss** responded. Assuming Murphy's Law has not been repealed (is this a safe assumption?), there is a good chance some of you did not receive the letter. If so, please let me know.

Norbert Andres continues his manufacturer's rep business selling computer peripherals. He also provides high-tech marketing consulting as president of PDQ Associates. Norb's wife, Pauline, has retired as a physical therapist, but she maintains her registry in Massachusetts as a graduate of BU's Sargent College. Norb says he is "working for the universities" since he and Pauline had five daughters and one son. Their son is the youngest and he is a junior in college. Yvonne, fourth oldest, is in a master's program. Another major financial expense has been two weddings with wedding number three scheduled in June of this year. The girls live in San Francisco, Atlanta, New York City, and Rochester, N.Y. Occupations include fashion model, nurse, bank executive, and computer sales manager.

David Vigoda and his wife, Sorina, have sold their longtime home in Weston, Mass., and their condo on Longboat Key. They have purchased a home on Lido Shores in Sarasota, Fla., and will live there full-time. They will continue to spend a couple of the summer months in Boston. . . . **Dan Muss** wonders if anyone remembers him

from our days at MIT. He has not attended any of our class activities since graduation. He retired after 34 years with Westinghouse in R&D in Pittsburgh. He and his wife, Carol, are enjoying sailing, SCUBA, travel, and amateur music making. . . . **Bill Weisz** was honored by the University of New Haven as the 1990 Distinguished Bartels Fellow. Before his fellowship address (about the renaissance in American competitiveness), he met with undergraduate business and engineering classes for discussions. Bill has spent 41 years with Motorola. From 1986 to 1989 he was CEO, and currently he is vice-chairman of the board and consultant to the company.

Jack Clifford still plays oldtimer's hockey. Jack was a very successful athlete during our undergraduate years. . . . **Dick Harris** and his wife, Rosemary, continue to enjoy retirement. They have a few grandchildren and one on the way. . . . **Ken Brock** continues to add to his civic responsibilities. He spends over 20 hours a week with one Cape Cod group. . . . **Al Seville** and his wife, Joan, enjoyed an extended ski vacation in Canada during the Christmas and New Year holidays. . . . **Robert McDonagh** retired from his job as chief engineer for the Department of Public Works in Massachusetts. —**Marty Billett**, secretary and president, 16 Greenwood Ave., Barrington, RI 02806, (401) 245-8963

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Gene Wroblewski writes: "I happened to be perusing the class of '46 notes when I espied the bold-faced name of an old high school classmate, Mario Vinci. He had entered the Navy V-12 program and was sent directly to MIT immediately after high school graduation. I, in the meantime, became a foot soldier in World War II and only returned to MIT the week he was graduating and was able to attend his class of '46 reception at Walker. I saw Dr. Karl Compton, president of MIT, standing to one side. In a moment of great bravado, I went up to him and introduced myself as 'an incoming freshman.' He, in turn, introduced me to the commencement speaker, General Jimmy Doolittle. I had not realized I was in a receiving line. I was so taken aback at the introduction to this famous personage, that all I could mutter was: 'I was in the Army, too.'"

"I contacted the MIT Alumni/ae Association for Mario's address. He replied immediately to my letter and we have been able to catch up on all the events of the past 40 years. Needless to say, we appreciate all these class notes."

We learn from **Axel Kaufman** that he is working on large projects at Jung/Brannen Associates, Inc., Boston, where he is a principal. Axel's projects include the State Street Bank Building renovations and new lobby. In his leisure time, Axel has served for two years as president of the Longwood Cricket Club. . . . From Little Rock, Ark., **Fred I. Brown, Jr.**, writes that he retired on December 31, 1990, as president of AFCO Steel but will remain a director. He is chair of the Executive Committee of the Worthen Banking Corp.

George Haviland out in Prescott, Ariz., has written to summarize his last 40 years in aeronautics. After a year at Grumman Aircraft, he returned to the Air Force on flying status. An MBA (University of Chicago) and a PhD (UCLA) brought retirement after a tour in Vietnam. He spent seven years as director of Structures and Design for the B-1A bomber, three years buying and running a mobile home park in Tucson, followed by a three-year stint as assistant chief engineer for Airframe on the Shuttle. "So," he says, "here I am teaching vector mechanics to students at Embry-Riddle Aeronautical University, playing a string bass at a local supper club, and playing as much golf as the Prescott weather will permit (we are at 5,700 feet above mean sea level)."

"Each issue of *Tech Review* is read from cover to cover, and you should know that those of us who read your news every time truly appreciate the effort you expend to keep us up-to-date."

As you read these notes, Technology Day, Friday, June 7, is only a few short weeks away. As always, the committee has worked hard to present a provocative program: this time centered on research in molecular biology being conducted at the institute. The theme of the program is: "Sex, Drugs, Genes, and Obesity."

Professor Eric Lander will discuss "Human Genetic Diseases and the Human Genome Project." Professor Robert Rosenberg has chosen the topic "Atherosclerosis and Heart Disease." Professor Herman Eisen will talk on "Immunity and AIDS," while Professor Robert Weinberg, '64, will discuss his pioneering work on oncogenes in a talk entitled "Human Cancer." Interested alumni/ae may call (617) 253-8230.—**Fletcher Eaton**, secretary, 42 Perry Dr., Needham, MA 02192; (617) 449-1614

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By the time this appears in print, it will be over a year since our 40th reunion. Looking back to that time it certainly was exciting to reminisce with old classmates. Unfortunately not all the class could get to the reunion and the major interest of all was to hear news about their fellow class members. Now is the time to get paper in hand and let all know about your activities. From conversations last June it appeared that many were contemplating retirement or have retired. Please drop us a line, especially those who have relocated. Address changes to the Institute are picked up easily, but news for your friends is slow to spread unless you write us about yourself. Please use that computer, pen or pencil and give us some new information.

William Moore 2nd was honored with an Honorary Doctor of Science from West Virginia Institute of Technology in 1988. . . . **James McAllister** indicates that after attending the 40th reunion, he and his wife, Hilde, have continued their travels throughout Europe. They spend time working with the Salvation Army, Boy Scouts, and the MIT Educational Council, as well as their church. . . . **John A. Gutai** has relocated to Carriots, Calif. He had been general manager for the Intex companies at their manufacturing facilities in Mississippi. He is now at headquarters located in California. Intex makes inflatable toys in the Orient for distribution throughout the world. . . .

Michael Gelentano retired from New York Telephone last year, and his wife Ellen joined him in retirement this year. He states that he is yet to meet a retiree who is not enjoying retirement. Since he spends a great deal of time on the golf course, along with being a volunteer guide at the Saratoga Battlefield, we see that he is keeping busy. Mike lives in Schenectady, N.Y. . . . **Juan Navia**, dean of the Univ. of Alabama-Birmingham School of Public Health, was selected by his colleagues to receive the most prestigious honor of the school, the 1990 Distinguished Faculty Lecturers Award.

We regret to have to inform you that **J. Murray Mitchell**, a distinguished government climatologist, has died. For over 35 years Dr. Mitchell was a senior expert on climate for NASA and other government agencies. He was one of the first to indicate that man-made effects on climate were no longer trivial and should be studied urgently. He spoke out on the warming of the atmosphere.—**John T. McKenna**, secretary, P.O. Box 376, Cummaquid, MA 02637

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40th Reunion

This issue will be arriving just in time to accompany your journey back to Tech to be part of the event of the decade, our 40th reunion. The carefully developed plans of reunion chairman **Harold Glenzel**, class fund chairmen **Bill Maini**, and **Marv Grossman** and their hard working committees have long since been completed. Now is the time for all of us to enjoy the fruits of their

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Richard Dattner FAIA, '60

labor and to relish in the pride of what our collective generosity will bring to our favorite institution. Have a safe trip to Cambridge. I am anxiously looking forward to spending time with you once again.

We received word from **Herb Scher** that he retired from Nevamar Corp. in February. Herb was senior vice-president for technology and finally the vice-chairman of the company. The Nevamar Corp. was a leveraged buyout from Exxon Chemical in 1978. The company was sold to International Paper this year. Herb is planning to do charitable work by helping the development of minority enterprises. He has long felt that they suffer from not having access to the contacts that other companies are able to exploit. The balance of his time will be devoted to his avid appetite for reading and for travel. In his note, Herb had one brief phrase about his five grandchildren—"they're all geniuses." In his modesty, Herb failed to mention that it was through his outstanding technical innovation and ability to bring out the best in others that he was able to elevate a good company into a major company in the highly competitive field of plastic laminates. He led the way for a company that now leads the way.

Your secretary, **Martin N. Greenfield**, has taken advantage of a favorable early retirement offer and has left Bull Information Systems, previously Honeywell Information Systems, after 34 years. I've tried to make it clear that I am not actually retiring, just making a preemptive dip into Bull's pension fund. After completing the development of an application for a Boston law firm, I will be working for UniSys Corp. as a database specialist developing safety information systems for the FAA.

Responding to our efforts to track some of our missing classmates, **Margaret Irby Koenig** informs us that **Nancy Keating Hauser** passed away in 1980. We wish to extend our very belated condolences to her husband, Wolf Hauser. I'm hoping that the prettiest of our classmates will follow up her note with one about her own career to include in a future issue.—**Martin N. Greenfield**, secretary, 25 Darrell Dr., Randolph, MA 02368

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Reunion chairman **Bob Lurie** reminds you to send your \$40 class dues, payable to MIT Class of '52, to **Stan Sydney**, 156 Tappan St., Brookline, MA 02146, along with the questionnaire regarding your intention to come to our 40th reunion next June. If you have lost the questionnaire, just send the check with a note indicating yes, no, or maybe. Please try to make it yes. As you should know by now, the reunion will be in Cambridge and in Harwichport at the Wychmere Harbor Hotel and Beach Club. A dedicated reunion committee continues to refine the many details necessary for a successful and memorable reunion. I must confess that it took Bob's request for a reminder to restart my procrastination mill, jammed as it is with put-off matters, including this column, and get my check written. My, I feel virtuous. . . . I shall also delay no longer to inform you that **Kenneth Childs**, president of Childs Engineering Corp. of Medfield, Mass., has been chosen president of the Boston Society of Civil Engineers.—**Richard F. Lacey**, secretary, 2340 Cowper St., Palo Alto, CA 94301

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Please send news for this column to: **Gilbert (Gil) Gardner**, secretary, 1200 Trinity Dr., Alexandria, VA 22314; (703) 461-0331

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Back in November, the Society for the Advancement of Material and Process Engineering held an international conference in Boston on "Ad-

vanced Materials: Looking Ahead to the 21st Century," and **Leon Michelove** was the lead editor for the proceedings of that meeting. Lee, at last report, was with Raytheon Co. in Bedford, Mass. . . . In its annual Christmas message, Crathern, the Schwenk's cat, informs us that the "Breakfast Club," described in this column a year ago, has been named a finalist for the national "Entrepreneur of the Year" award. The "Breakfast Club," you may recall, is a group of four who back new company start-ups. Two of the four are our own **George Schwenk** and **Dick Morley**. . . . **Rog Griffen** reports that he has completed 20 years at marine hydraulics in Lutherville, Md. He and Elaine also write that the children and grandchildren are all well and living elsewhere, so they are trying to adjust to their empty-nest environment.—**Edwin G. Eigel, Jr.**, secretary, 33 Pepperbush Ln., Fairfield, CT 06430

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Allen Wahlberg has been elected senior vice-president of The Turner Corp. In addition to his new responsibilities as senior vice-president, he continues as chief financial officer with executive management responsibility for the treasury and accounting functions, pension fund investments, and internal auditing. Excepting a tour of duty with the U.S. Army from 1957 to 1959, Allen has been with Turner since 1956. He was elected to a vice-president in 1980, and became chief financial officer in 1985. The Turner Corp., through Turner Construction Co. and other subsidiaries, is the nation's largest builder of commercial, industrial, hospital, institutional and government buildings. During 1989 Turner completed \$3.6 billion of construction. Allen and his family reside in Hokenus, N.J., where he serves as a member of the Borough Council.

Alfred Wechsler, senior vice-president and chief professional officer at Arthur D. Little, Inc., Cambridge, has been elected a director of the American Institute of Chemical Engineers for a three-year term beginning January 1, 1991. Al has been with ADL for nearly 30 years and has conducted and managed research and engineering in high and low temperature materials, heat transfer, aerospace and space instrumentation, biomedical engineering, and health, safety, and environmental engineering. He now holds worldwide responsibility for the professional content and quality of ADL's consulting in technology and management. He is a member of the visiting committee of the MIT chemical engineering department, and the industrial advisory council of the University of Lowell chemical engineering department. He also has served on the National Academy of Sciences/National Research Council committee on chemical engineering frontiers, and has been active in the Society of Automotive Engineers' science and engineering activity committee, the American Institute of Aeronautics and Astronautics, and the American Chemical Society. Al is an elected fellow of the American Association for the Advancement of Science.

John Farmer was re-elected to the Vermont Senate last fall with over 70 percent of the votes cast. John and Judy continue to enjoy life in Stowe, activities of their children and grandchildren, and have been doing considerable traveling. . . . **Edie** and **Bob Greene** finally have their new home on Cape Cod. They purchased a ranch house in Cummaquid Heights off Rte. 6A in Barnstable County. Bob is practicing up on his golf.

We regret to report the death of **Everett Gerrish** last December at Southern Maine Medical Center in Biddeford after a brief illness. Everett was employed by the Gould-Shawmut Co. in Newburyport, Mass., working in the Electrical Fuse Division. Our sincere sympathy goes to his wife, Julie.

As I write this in the midst of winter, with holiday notes from some of you as part of my material, it is hard to believe that by the time you get

to read this, Technology Day will soon be upon us. Do set aside Friday, June 7 and attend, even though this is not a reunion year. The program sounds great, as usual, and the more of us that attend the more successful an event it will be.—Co-secretaries: **James H. Eacker**, 3619 Folly Quarter Rd., Ellicott City, MD 21043; **Roy M. Salzman**, 481 Curve St., Carlisle, MA 01741

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35th Reunion

Meetings continue for the 35th reunion to be held on campus September 26-29, 1991. (A January reunion meeting coincided with the commencement of "Desert Storm"; affairs of note off occur on the same date.) We can look forward to a good panel discussion on "ethics" Friday morning. (**Warren Briggs** and **Klaus Kubierschky** have done an admirable job of lining up speakers of note from Sloan, Harvard B, and the Union of Concerned Scientists, etc.) Friday night is scheduled for a dinner/dance at the MIT Museum. (Jay Kaiser, an assistant provost, is to provide an interesting adlib on ethics as well as music.) Saturday night will be a dinner/dance at the Museum of Science, with a special class showing of a current topic at the Omni Theater. Sunday brunch will have Lester Thurow, dean of the Sloan School of Management, speak on the current economic environment issues. All who have heard presentations of selected speakers proved enthusiastic in their support of the nominees. Active athletics, spectator activities, tours, and other items of interest are to be included, both on campus and in Boston. (Some unconfirmed rumors to rebuild the Old Howard for a class act.)

Howard Trachtenberg is looking forward to the 35th reunion. Everything is going very well. The only exceptional news Howard has to report since his last communication is the expectant arrival of grandchildren three and four. . . . **Ward C. McCallister** passed on in May 1990. He was living in Glen Ellyn, Ill. Ward had an interest in and supported the MIT executive education programs at the Sloan School of Management.—Co-secretaries: **George H. Brattin**, 39 Bartlett St., Andover, MA 01801, (508) 470-2730; **Irwin Gross**, Sweets McGraw-Hill, 1221 Ave. of the Americas, New York, NY 10020, (212) 512-3181

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Please send news for this column to: **John Christian**, secretary, 23 Fredana Rd., Waban, MA 02168

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For many of us who are concerned about the future of manufacturing industries in the U.S., this letter from **Ed Goldman** will be of particular interest. "In addition to my job as a vice-president of Foster-Miller, I am working on a U.S. 'Manufacturing Awareness' campaign with the National Machine Tool Builders Association and the National Association of Manufacturers. I would certainly welcome any assistance or advice any classmate might have on this topic. Just call or write me at our company offices in Waltham, Mass."

From the now unified Germany, **Bob Baber** writes, "For Ursula and me, the main news is that our daughter, Ingrid, announced her engagement to a young man from Scotland. Our son, Eric, is an English and drama major studying in Hull, England. I'm glad I studied engineering, as I would never have been able to read as much as he must. Recently, Ursula started teaching German for foreigners at an adult education center in Frankfurt. Since some of the participants cannot read their own language very well, it is a doubly challenging pedagogical task. My third book on software was published in Germany last year, and I have just translated it for Wiley, who will publish it under the title *Error Free Software*."

Professional activities are keeping me busy as I have been elected a fellow of the British Computer Society and have just become vice-chairman of the German section of the IEEE. The German unification was the big event here in 1990. Rebuilding the economy will not be easy, but there is considerable good will on both sides, and West Germany is in a good financial position, so the long term prospects are quite good."

Seen rendezvousing on the island of Tortola in the British Virgin Islands in January, were Mary and Sars McNulty, Beth and Al Russell, and Nancy and Mike Brose. A week of bareboat sailing, sunning, and snorkeling served to sooth the senses. On the way home, the Russells stopped off in Puerto Rico to meet another vacationing couple, Ceres and Joel Shulman. Joel is a systems engineer with IBM in New York.

This year's Technology Day program will be on "Sex, Drugs, Genes, and Obesity—The Impact of Molecular Biology on Your Health." If you're in Boston or traveling to the area on June 7, be sure to attend. Call (617) 253-8230 for more information.

Another new address for us as we've moved from the temporary apartment to a house on the river here in Elkhart. Our new home phone is (219) 264-4838. Keep those cards and letters coming.—Mike Brose, secretary, 1619 Greenleaf Blvd., Elkhart, IN 46514

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Please send news for this column to: **Allan S. Bufford**, secretary, Office of the Treasurer, MIT, 238 Main St., Suite 200, Cambridge, MA 02142

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In response to my plea for class notes, I received a letter from **Robert Gurnitz** who decided that he would respond "at least every 30 years." (If more of you would do the same, I'd have no problem coming up with material for this column.) Bob enclosed a press release noting that on January 1, 1991, he had become president and CEO of Northwestern Wire and Steel in Sterling, Ill. According to Bob, Northwestern is "a super company with 51 percent of the shares held by employee/owners." Prior to joining Northwestern, Bob had been president and CEO of Webcraft Technologies, New Brunswick, N.J. Bob and his wife, Ellen, recently visited Mike and Beth Kasser at their Kona, Hawaii home. Bob wrote that Mike "keeps a great balance between the world of business and taking time to smell the flowers," which are in abundance at his Hawaii home. Best wishes with your new responsibilities, Bob.

Samuel Gorowitz, dean of the College of Arts and Sciences and professor of Philosophy at Syracuse University has a new book, *Drawing the Line*, is an examination of the ethical questions of life and death decisions and how they should be made. Sam drew much of the material for his book from seven weeks at Boston's Beth Israel hospital where he had free run of the hospital and an opportunity to observe the ethical dilemmas posed by modern medicine. Sam's book has received acclaim from, among others, Norman Cousins, Studs Terkel, and the *Journal of the American Medical Association*.

Along with other class secretaries, I was asked to pass along the gist of two memoranda from the Institute. The first is that this year's Technology Day program on June 7 will feature a session on "Sex, Drugs, Genes, and Obesity—The Impact of Molecular Biology on Your Health." (I think that covers something for just about everyone.) The program features morning speakers on human genetic diseases, atherosclerosis, and heart disease, immunity and AIDS, and human cancer. The afternoon will include a panel discussion of the clinical and ethical issues of the research discussed by the morning's speakers. Contact the reunion office, (617) 253-8230, if you're interested.



Ellen and Bob Gurnitz, '60 (left) and Beth and Mike Kasser, '60, in Kona, Hawaii.

I was also asked to make you aware of a new organization at the Institute, the Emma Rogers Society, formed to keep alumni and faculty widows connected to the Institute. A letter to Betty Millard, the Society's manager, at MIT will bring you more information about the Society.

I don't want to appear maudlin, but many of the items in this column, coupled with my recent unhappy experience of attending the funeral of my best buddy from high school, urge me to remind you all—take care of yourselves and enjoy.—Frank A. Tapparo, secretary and class agent, 15 S. Montague St., Arlington, VA 22204

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30th Reunion

Please send news for this column to: **Andrew Braun**, secretary, 464 Heath St., Chestnut Hill, MA 02167

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H. David Stein writes that he is now professor of surgery at Albert Einstein College of Medicine and chairman of surgery at Flushing Hospital Medical Center. More important, Dave's daughter, Lynn Stein Melnick, was just appointed assistant professor of computer science at MIT. Dave wants to know if any of our other classmates can claim children on the faculty at MIT?

Thomas P. Sheahan, once famous intramural hockey manager and varsity hockey leader in penalties received per minute played, continues to referee hockey games in both the Chicago area and the Washington, D.C., area. Tom, motivated by his all-star hockey-playing sons, Allan and Andy, has recently resumed playing in an "old man's league" (with no checking). It looks like Tom ranks right up there with Jim Palmer on the comeback trail to athletic performance. Good Luck in the penalty boxes, maybe you can break your old record?

The 1992 America's Cup preparations are back in the news. The *Ninantic* (Conn.) *News* tells us that **William Koch** and his design team are busily constructing their entry in Bristol, R.I. It seems that Bill and Dennis Conner will go head-to-head with boats built within a stone's throw of each other. Bill's entry is said to emphasize technological breakthroughs with certain artistic innovations (appropriate to its MIT heritage). Bill's entry will not display advertising logos as the others are expected to do. But it looks like our classmate will have to contend with Beach Boys USA (talk about 1960s nostalgia) as well as Team Dennis Conner to have the honor of defending the America's Cup in 1992.

Donald C. Fraser left the Draper Laboratory in November 1990 to assume the role of deputy director for operational test and evaluation for C³I at the Pentagon. Fraser will be at the Penta-

gon for a two-year term. Don will oversee operational test and evaluation of all new weapons' systems. He will be monitoring over 200 Department of Defense programs that are handled by C³I. I suspect Don will get some first hand observations and analyses from the Middle East. We can take some real pride in our classmate's work on weapons' systems that are apparently doing what they were designed to do.

We are always looking for news concerning our classmates. Please drop me a line whenever you get the chance.—Hank McCarl, secretary, P. O. Box 352, Birmingham, AL 35201-0352

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What a delight to have a full bag of news to pass on to you. **Rick Merrill** (445 Sugar Rd., Bolton, MA 01740-1131) left DEC last year after about 24 years to go with Atex. He works on publishing systems and is "having a blast." He has twin 20-year-old daughters who are both math majors finishing their third years at Simmons College. His son, John, 11, a high school junior, has taught himself to juggle just about anything. . . . **Howard Piele**, who lives in Munster, Ind., is in iron- and steel-making science with Inland Steel. His wife Barbara is a division manager with World Book Educational Products. Both their sons are studying in Israel: Yaakov is at the Mirror Yeshiva in Jerusalem, and Eli (the younger) is at the Yeshiva Sha'alvim. . . . **Lennart Ehn** has spent 26 years in construction and real estate, most recently as senior vice-president of Hazel/Peterson in Fairfax County, Va. He is on sabbatical and now in California. . . . **Elliott Bird** and his wife Toby are completing one-year sabbaticals from Nassau Community College and Long Island University/C.W. Post respectively. They are doing travel, theater, and opera. Part of the travel was three weeks in October in Montpellier, France, where one-quarter of the 300,000 inhabitants are students, giving this ancient city a paradoxical feeling of youth. They also visited Nice, Marseilles, and Lyons. Elliott, who consults with local schools, acclaims the *Comprehensive School Mathematics Program*, a non-commercial K-6 program. It is a method by which young children can learn math while enjoying and understanding it in a problem-solving framework that encourages debate.

Gary Jensen is now chair of the math department at Washington University in St. Louis. His immediate priorities are a reevaluation of the curriculum and a search for new faculty. . . . Closer to home, my personal-computer consulting business, Training To Go, is still alive after two years, which amazes me. I have expanded beyond software training to database programming, and continue to contract with both end users and software resellers. My son Gary, now 21, is finishing his second year of grad school in the

Department of Cognitive Sciences at MIT, and had one of his papers published as a monograph. Daughter Julie, 2, is talking a blue streak and continues to prove to Linda and me that she is the boss. She loves the "Turtles." My wife, Linda Marsden, continues to have great success developing and delivering courses on customer service, self-esteem, performance evaluation, etc.

Don't forget Technology Day, June 7. The topic is "Sex, Drugs, Genes, and Obesity—The Impact of Molecular Biology on Your Health. (How can you pass up a scholarly discussion of sex?) For information, call (617) 253-8230. Meanwhile, keep those letters, phone calls, e-mails, and other mis- sives coming!—**Phil Marcus**, secretary, 3410 Orange Grove Ct., Ellicott City, MD 21043, (301) 750-0184, Compuserve 72047,333

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Once again I must begin the column with some sad news. **Ed Shibata** was kind enough to send along an obituary notice from the *Albuquerque Journal* concerning his former MIT roommate **John Freeman**. John died in an automobile accident on September 26, 1990 at the age of 47. He is survived by his wife Margaret, his son Lincoln Joseph, and his daughter Jennifer. John came to the Institute from Gallup, N.M., (along with Ed). After receiving an SB, he went on to the University of New Mexico where he earned an MS and PhD. John was employed at Sandia Labs in Albuquerque for more than 25 years, where he gained an international reputation for his work in the physics of high energy density matter. His most recent accomplishment related to the physics of the instabilities of heavy ion beams for fusion energy production. John maintained a lifelong interest in exotic cars: at various times, he was busy restoring Ferraris, Porsches, and other makes in a garage at home described as the envy of many professional mechanics. I'm sure you all join me in extending sympathy to John's family, as well as to Ed Shibata who has lost a longtime friend.

Some end-of-the-year Alumni/ae Fund generosity on the part of several classmates also included news notes. **Jack Clark** writes from Westminster, Md., that after forays into rock climbing, bicycle racing, and go, he has now become addicted to opera. Jack indicates that he keeps himself mathematically busy with the puzzle feature of this magazine. . . . **Tom Cheek** has been running his own company, Novographics, which specializes in consulting and product development for electronic document processing. Most recently, the company has concentrated on CD-ROM publishing. Tom and his wife, Susan, live in Lexington, Mass., with their two sons. . . . The war in the Gulf prompted a CNN news special on the circumstances and attitudes of Iraqi Jews now living in the United States. Our classmate **David Sheena** whose family emigrated from Iraq quite a few years ago, was among those interviewed. He provided some very thoughtful insights about the differences between the two societies.

Louise and I have just returned from our two-week sunshine sanity break in Palm Desert, Calif., and are now able to hang tough for the rest of the winter till the golf season starts again here in northern New England. Recently, I've had the good fortune to run a small research project applying systems engineering techniques to coronary artery bypass surgery. Quite interesting and challenging, especially the "up close and personal" observation sessions in the operating room—particularly for a person who has never had a biology course in his entire life.

Best wishes to all for a happy summer! Please write.—**Joe Kasper**, secretary, RR2, Box 4, Norwich, VT 05055

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This month's column features **Bruce Morrison**, who strove mightily to become governor of Con-

necticut. Bruce, as many of you know, was the Democratic candidate for governor in a three-way race with Lowell Weicker, who ran as an independent and won with plurality, and John Rowland, the Republican candidate.

I met Bruce when we were at Senior House. He joined our class by graduating from MIT in three years in organic chemistry, then went on to earn a master's at the University of Illinois, and later switched to Yale for a law degree. His first job was with Legal Services in New Haven, representing poor families. He earned a reputation as a very hard working, dedicated lawyer who wanted to protect the concept of equal justice. By 1976, he was director of the New Haven office. Bruce is divorced from his wife of 17 years and has no children.

His political career began in 1982 when he won a close race (one percent) to begin an eight-year stint as Congressman from Connecticut's third district. He survived a close race in 1984 and then had little opposition in 1986 and 1988. Bruce is an old style Democrat. He believes that the government must play an activist role in ensuring that all people, have an opportunity for a good life. He has a strong record on environmental and educational issues.

Bruce says his decision to run came when the previous governor, Bill O'Neill, was still a candidate for re-election. Bruce felt it was time in his career to move into an executive area, where government is really done. He felt the O'Neill administration had let things get out of hand fiscally, and that O'Neill's posture gave an alternative candidate an opportunity. It turned out this was an accurate assessment.

In this era of difficult financial times for government, Bruce ran a campaign where he insisted the voters would need to decide, in a referendum, whether they wanted more taxes or a reduction in services. To many observers surprise, he handily won the nomination in September over William Cibes.

Lowell Weicker was the wild card. Bruce had asked Weicker in October 1989 whether he would run, and had felt Weicker would not do so. Bruce knew Weicker was a formidable opponent for governor.

In the end, Bruce attributes his loss to an inability to raise the competitive ad dollars. Both Weicker and Rowland outspent him in the election by two or three to one.

What now? Bruce has immersed himself in working on the massive immigration law change that was passed in the last Congress. Bruce chaired the Immigration Sub-committee that passed this major revision of the law and finds there's a lot of work to be done. He's working primarily with private law firms in Washington and probably will join one of them.

While Bruce doesn't rule out a further political career, he feels he'll only step into the arena if there's a job he wants to do and there's a good chance of election. As an "out," he doesn't have much clout now in the insider games but still has a following in the media.

Asked how his MIT background helped or hurt (several media articles highlighted Bruce as an "intellectual" or "professor"), he's quick to say there's a good argument that substance doesn't count in American politics. He felt he was respected in Congress for his background in quantitative thinking and logic and that it really helped him do his job but wasn't any help in the election.

We wish Bruce well in his new career and, if the chance comes again, success in politics.

News, as always, is welcome.—**George McKinney**, secretary, 33 Orchard Rd., Chestnut Hill, MA 02167, (617) 890-5771

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25th Reunion

Please send news for this column to: **Jeff Kenton**, secretary, 7 Hill Top Rd., Weston, MA 02193

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John Rudy reports that our 25th reunion is set for the second weekend in June 1992. Mark your calendars now! If you wish to help out, give John a call (work: (508) 858-5768, home: (617) 861-0402). The first committee meeting was attended by **Don Mattes**, Pam Levangie, **Mike Schiff**, and **Joel Shwimer**, in addition to John. Apart from reunion activities, John has been keeping very busy at Raytheon, which designed and manufactures the Patriot missile. I applaud Raytheon and its employees for doing such a tremendously professional, highest-quality job on this spectacular defense product. Raytheon's manufacturing plant has been working three shifts to handle demand for this product, and **Bob Ferrara**, who is Raytheon's data processing/information systems manager, has been kept quite busy. John's son, Brett, is in the business program at Northeastern. John bought him a small computer/word processor and can vividly remember what it was like when he was a freshman having to retype papers. . . . **David Ofsevit** has been at DEC nine years and still lives in the Boston area. He devotes most of his leisure time to his son, Ari, 6, and his daughter, Leah, 3.—**Jim Swanson**, secretary, 878 Hoffman Terr., Los Altos, CA 94024

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Please send news for this column to: **Gail and Mike Marcus**, co-secretaries, 8026 Cypress Grove Ln., Cabin John, MD 20818

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If you have a burning desire to learn the latest words that Oprah Winfrey, Ted Koppel, Phil Donahue, or their guests have launched over the airwaves, contact **Journal Graphics** in lower Manhattan. A decade ago, our own **James Arthur Smith** founded the highly successful \$3-million-per-year transcript firm where every week 15 transcribers tape and type 650,000 words from TV-radio-land. Smith's firm pays some popular shows to do their transcripts, but less notable ones pay **Journal Graphics**. Jim's customers, the bulk of whom are simply curious listeners who may have missed part of a captivating segment, pay \$3-\$6 per transcript. A reporter for the *Gannett* newspaper chain describes Jim Smith's MIT days: "Born in Maine, Smith attended Massachusetts Institute of Technology for four years, but never graduated. In fact, he says, he was a pretty bad student. 'I majored in extracurricular activities and electives,' he says. He never completed freshman physics, freshman chemistry, and freshman math. The only requirement he completed was physical education, earning a 'C' in diving." Listen up all you moderate-wage PhDs!

David A. Frank has been elevated from executive vice-president to president of Margaretten and Co. of Perth Amboy, N.J. . . . **Mark L. Braunstein** has resigned as president of National Data Corp.

Louis S. Metzger has been promoted to technical director of Strategic Communications within the Center for Air Force C³ Systems at the MITRE Corp. in Bedford, Mass. . . . **Kathryn K. James**, who is going in another direction, writes, "I recently changed jobs and am now a senior engineer working at TRW on air traffic control support. This is the first time since February 1973 that I have not worked in defense, and I'm looking forward to all the changes that this will bring to my professional life."

A month after we entered MIT in 1965, **Julian Schwinger**, **Sin-Itiro Tomanaga**, and **Richard P. Feynman** won the Nobel prize for physics. Schwinger, who received a review manuscript of my forthcoming book, *Fire From Ice*, had this to

say: "Eugene Mallove, in my book, is the right one to write about 'the truth behind cold fusion.' He has produced a sorely needed, accessible overview of the cold fusion muddle. By sweeping away stubbornly held preconceptions, he bares the truth implicit in a provocative variety of experiments." More welcome words an author could not have wished. Schwinger has developed his own theory of how cold fusion—if it is real—may work. I have my own theory: a lot of skeptics are going to be eating much crow before long. Only time will tell who will attend the banquet.—**Eugene F. Mallove**, secretary, 171 Woodhill-Hooksett Rd., Bow, NH 03304

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Martin Langeveld tells us that he has been appointed vice-president and chief operating officer of Eagle Publishing Co. Eagle, based in Pittsfield, Mass., operates four daily newspapers in western New England and commercial printing and real estate development divisions. Martin also has been elected president of the Hancock Shaker Village, what he describes as the "premier historically restored Shaker village" in the country.

Jim Hecht has relocated to Davidson, N.C., where he has become vice-president for parts and distribution at Ingersoll-Rand Co. . . . **Dave Alperin** makes us feel our age. He reports that his first son is now a freshman at Northwestern University, his second son is regional vice-president of USY, and his third son has been bar mitzvahed. Congratulations, Dave.—**Greg and Karen Arenson**, secretaries, 125 W. 76th St., Apt. 2A, New York, NY 10023

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20th Reunion

Our 20th reunion is coming up June 6-9. If you haven't already done so, please send in your reservations. If you can't come, please send in \$20 for your Class of '71 dues. June 6: Tech Night at the Pops, Pre Pops Buffet Supper at the Student Center and buses to Symphony Hall. June 7: Technology Day. The morning program is entitled, "Sex, Drugs, Genes and Obesity—The Impact of Molecular Biology on Your Health." The Technology Day luncheon will be at the Athletic Center and the Class of '71 party will be informal with lots of time to get reacquainted. Saturday, June 8: Techs barbeque—lunch will feature a genuine southern barbeque followed by family games and a magic show. Class of '71 dinner at the MIT Museum will be our big event, the chance to renew old friendships and new. The reunion ends on June 9 with a brunch and class meeting.

Bob Terwilliger is the reunion chairman and has an excellent hotel in Boston. Bob tells me that the room should go for twice their price, that the view is great, the service incredible and the rooms are immaculate.

Robert H. Price was recently promoted to senior principal scientist with Jaycor. He is working the statistical theory of EM fields in complex irregular cavities and on a new type of tactical microwave weapon. He is also making a large x-ray mirror. He and his wife, Connie, still enjoy life in Santa Fe, where she is a successful real estate agent. . . . **Edward T. Brogan IV**, now lieutenant colonel, is in San Antonio and responsible for three congregations using the newest (award-winning architecture) chapel in the Air Force. . . . **Jerry S. Greer** has a new position as engineering project manager in the newly formed Monitoring and Evaluation Department at Boston Edison. He is responsible for verifying the energy savings achieved by their conservation and load management programs.

Jonathan Y. Lukoff, MD writes to tell us that any contributions to the '71 "class gift" are also appropriated to the general fund. You have to state that the contribution is for the "Kent State Gift." Because of this, only \$6,000 has been con-

tributed to the class gift. . . . Nancy and Mike **Chrzanowski** write: "Anyone who is a member or associate member of Lambda Chi Alpha is invited to contact us for planning a reunion for the summer of 1991, (713) 360-2925"—**R. Hal Moorman**, secretary, Box 1808, Brenham, TX 77834-1808

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Robert Reiter and his wife "enjoyed a wonderful weekend (November 2-4) in Boston, celebrating the 100th anniversary of the Chi Phi chapter at MIT. I met her 20 years ago at a fraternity party at the Chi Phi house in Back Bay. Delightfully unseasonable weather and many fond memories."

Mark Letner has become vice-president of operations at McNeil Consumer Products Co. in Fort Washington, Pa. He has held a variety of positions with them since earning an MBA at Wharton. He, his wife, Mary Jane, and son, Matthew, live in Blue Bell, Pa. . . . **Marjorie Jeffcoat**, chairwoman of the University of Alabama at Birmingham School of Dentistry's Department of Periodontics has been awarded the Harvard Dental School distinguished alumni award.

Got a fine Christmas letter from **Marty Shinko** detailing the adventures of wife Cher, daughters Kelly, 5, and Amy 2, and the two goldfish. Highlights included a trip to Disney World and a new swimming pool. Marty is working on the Hubble Space Telescope for Unisys at the NASA's Goddard Space Center, doing quality assurance on software and ground operations.

Please write Wendy or me about the interesting things in your life like new goldfish, or even the less interesting things like marriages, jobs, and degrees.—**Dick Fletcher**, co-secretary, 135 West St., Braintree, MA 02184

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Richard Hill recently published a work entitled *EDI and X.400 Using Pedi*. Published by Technology Appraisals in the U.K., it offers an explanation of the use of CCITT Recommendation X.435 to provide Electronic Data Interchange services. It is available by mail order from the publisher at Grove House, 551 London Rd., Isleworth, Middlesex TW7 4DS, U.K. Our wishes are for great success in its promotion.

David Moylan and wife Denise have celebrated the arrival of their third child, Lauren Victoria on April 19, 1990. Precious little else, unfortunately, has been heard from our classmates, but I'm sure the interest in your pursuits is rampant among them, so please—write!—**Robert M.O. Sutton, Sr.**, secretary, "Chapel Hill," 1302 Churchill Ct., Marshall, VA 22115

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Camper classmates, this is being written in early February, 21 days after the start of Operation Desert Storm. I hope by the time we all read this that peace and rebuilding have returned to Iraq. If you or someone you know is involved in the Gulf War, please write me so we can collectively share our support.

Speaking of rebuilding, **Jeffrey Ng** has been busy working on a master plan in Long Beach, Calif., a museum renovation of the old U.S. Custom House in New York City, an addition to the Queens Courthouse, and other duties in the architectural firm of Ehrenkrantz, Eckstut and Whitelaw. His son Thaddeus recently turned 2, and his wife Winnie takes care of him and is an assistant professor in computer science at the University of Southern Connecticut. Busy, busy, busy.

Elaine and Gary Raymond announce the recent arrival of son Nathan Reuben, born January 18, weighing 6 pounds 11 ounces, and stretching all of 20 inches. Welcome to the class of 2013.

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Obesity, are the topics for this year's Technology Day and hey, even two out of four ain't bad! The program, planned by the biology department, highlights the impact of molecular biology on your health. No invitations necessary, admission is free, Friday, June 7. Plan to attend.

A bimonthly video "magazine" entitled *PC Vision* started up in March, with Managing Editor **Paul Schindler** at the helm. The hour-long video format proves the adage "seeing is believing," providing software and hardware demonstrations, lab tests, interviews, and feature stories. . . . "I really found work I enjoy," writes **Tom Wolff**. "I changed careers within Amoco last winter and am now a chemistry, technology, and patent information scientist."

An article featuring **Steve Fantone** and his company, **Optikos Corp.**, was published recently in the *Mass High Tech Journal*. Optikos, as Steve points out, "is capable of serving as a complete optical engineering department" for companies that incorporate optics into their products. Optikos is approaching the end of its first decade of existence, employs 20 people, is strong and growing cautiously. "To me," saith Stephen, "it was a great discovery to learn that I could make a living with interests I had developed as a child." Two of Optikos' products are the viewfinder in the Polaroid Spectra camera, and the Fisher-Price Sunjammer sunglasses.

Speaking of sunglasses, enjoy your summer!—**Lionel Goulet**, secretary, 115 Albemarle Rd., Waltham, MA 02154-8133

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A nice letter from **Ernest C. Brown**: "After 16 years, my first letter! Barbara Sheridan Brown (Wellesley, '76) and I were married in 1977 while I was finishing a joint MSCE/JD at UC/Berkeley. We now have two sons (Chris, 7, and Mike, 3) and a new daughter (Elizabeth, 6 months). After Berkeley, I spent ten years working as a lawyer and partner in several large law firms and at what is now Fluor-Daniel Corp. In 1989 a group of us from those years founded Ernest Brown & Co., a construction and environmental law firm. We now have five offices in California and Arizona with about 35 people. Our projects include acting as special counsel for the \$257 million John Wayne Airport, the \$80 million Anaheim Sports Arena, and litigation for other large public works projects in the Southwest.

"Recently, I was interviewed on CNN for my involvement in initiating a pro bono legal program for families of servicemen involved in the Gulf War. We now have over 75 volunteer lawyers in Orange County working on the project. I look forward to hearing from other Class of '75 lawyers and Course I grads when they are in southern California."

A couple of other items: **Skip Richards**, after 15 years with Data General Corp., has become vice-president, research and development, of HyperDesk Corp., a company founded in December 1990 to market a new class of distributed computing software. The HyperDesk technology will allow users of a wide variety of PCs, workstations, servers, and networks to access applications, data, peripherals, and other resources located anywhere on the network, from a single graphical interface. . . . Although I mentioned this briefly in my last column, I can now provide facts and figures. Charles Joseph Lasky was born to **Susan Fuhrman** and Larry Lasky on June 16, 1990. Charlie weighed in at 8 pounds, 1.5 ounces and, at least as of 6 months of age, is "good and cute and laughs and talks and grabs at everything within reach."

I spent the month of January and most of February at a trial in San Francisco between Du Pont and Cetus Corp. At issue were Cetus' patents on the polymerase chain reaction, or PCR, a technique for amplifying DNA. The jury is deliberating as I write this column. While in San Francisco, I had dinner with **Elizabeth Spiess**,

who is presently employed as a senior scientist at Applied Biosystems, Inc., in Foster City, Calif. We had a great time catching up after being out of touch for almost 10 years. Betty's life has progressed farther than mine—she has three cats and I have only two!

How about hearing from some of you other out-of-touch classmates?—**Jennifer Gordon**, secretary, 18 Montgomery Pl., Brooklyn, NY 11215

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We finally have a decent amount of news, after all my entreaties. Many thanks!

From **Dan Jabolonski**: "I've been working at the supercomputing research center in Bowie, Md., for the past four years. Our son, Matthew, will be 5 at Christmas." . . . **Mauri Rosenthal** writes: "I live with my wife, Nancy Teubenslag, and son Alex, (age 4) in Scarsdale, N.Y. I work for Pfizer Hospital Products Group as director of Strategic and Business Planning. Recently, I've been trying to put my Course VII lab skills to work as a home brewer." . . . **Jack Cheney** is "happy to have an SM in mechanical engineering at Cornell finished. He's back at work at Corning as manager of Batch Facilities Engineering. Karen and the three youngsters are fine and also happy to have me back from 'homes' of the master's program."

"While still working for Stanford University," **Sue Tonik** has "formed my own company, called ASHA Environmental, Inc. It has a license from Stanford to use, sell, and develop the hazardous materials storage and reporting database that originates there." . . . **Courtney McCracken** has, "after four years in Africa and Europe, [become] the Public Works officer at a naval weapons station. Lynn's teaching aerobics, and we both try to keep up with the activities of our rapidly growing brood (Ryan, 12, Eammon, 9, and Siobhan, 6)." . . . **George St. George**: "Not much has changed for me in the last year: I've bought more comic books, lifted more barbells, had more of my march compositions performed, etc. I have, however, joined a video dating service in an attempt to end thirty something years of bachelorhood. I've met some fine women, but nothing has really 'clicked' yet. Maybe I should save my Curly impressions for after the first date."

From **David Leighton**: "We are moving into adoptions with our foster twins, Cassey and Corbin, age 22 months. Our oldest son, Joshua, age 5, is in kindergarten. His brother Christopher, age 4 is in Head Start." . . . **David Snyder** is "currently an attending psychiatrist and director of Adult Psychiatric Services at Hampton Hospital in Westhampton, N.J. Received an MD in 1980 from Hahnemann University and am board certified in general and child psychiatry." **Jim Ryan** writes: ". . . a terrific new job with a software company (Breure & Co.) in Bedford, Mass. The company does job-cost accounting software for DEC VAX systems. Found another alumnus is there, Judy Liss, SM Sloan '83. Also saw Ken Miller ('74, Sloan '83) at Thanksgiving—he is well, but having a hard time finding a job."

Melissa Weiksnar is now director of Operations for Synernetics, Inc. ". . . Synernetics announced our second product in October. In two years we have grown to nearly 50 employees. If you need performance networking, talk to us! . . . Jeff and I are not immune from the dual career affliction of finding enough time for each other! Family, Philip is 6, Evelyn, 5, and Amelia, almost 2. Philip keeps us challenged with questions like 'What's the most modern country?' I've been working on a lot of poetry: one poem published so far, hopefully more soon." . . . From **David Littleboy**: "After two years at NEC and another two at AT&T (both in Tokyo), I've set out on my own as a free-lance translator (Japanese to English). Although 'independence' has its own set of headaches and worries, all in all it's a great improvement over being a cog in the corporate machinery."

Michael Golan has finally written. "I'm an MIT

15th Reunion

alumnus who has lost touch with MIT. Lately I've become aware of the many ways MIT still touches my life; during the holiday season many of the cards I receive were from people I met at MIT and who are still close (though distant) friends. Someone I work closely with has a daughter in the freshman class at MIT. I enjoy hearing what life is like there now and telling what it was like just 15 years ago. I'm interested in sailing and keep seeing Bill Koch's name in magazines and videos. And in these tough economic times I'm thankful that MIT helped develop me and my talents. I feel that a lot of what MIT did for me helps keep me employed."

Kudos to **Gregory Hawkins**, PhD. He has been appointed a managing director at Salomon Brothers, Inc., in New York. . . . Additional kudos go to **Steve Edelson**, chairman and CEO of Edson Labs. Steve has a major hit with a new chip that will radically, and cheaply, improve the resolution performance of computer monitors. A plethora of video-display manufacturers have signed on already, and his product, which is the culmination of 10 years of effort, is getting great trade press.

Please remember that we are having our 15th reunion. Hopefully, this issue of the *Review* will reach you prior to the planned events and spur more of you into going. Imagine—15 years since 1976 already. It seems like minutes ago.

As for your secretary, he is still experiencing very slow progress in moving speech recognition into the marketplace. I have learned that marketing the Voicebox, our first product, and trying to do technology licensing deals is at least as difficult as trading futures. We have the classic problems of getting distribution and trying to take a growing body of technology and commercializing it. The potential remains tantalizing and the frustrations immense.

Please write or fax. We can always use the news. Hopefully, our 15th reunion will provide a great deal.—**Arthur J. Carp**, secretary, Voice Recognition Technologies, Inc., 220 Henley Rd., Woodmere, NY 11598; (516) 295-3632, fax: (516) 295-3632

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Only two pieces of news this month, classmates. I hope that will serve as an inspiration to those of you who like longer columns! The first piece of news is a reminder that Technology Day is Friday, June 7, and even though we are not a "reunion year" class, all are welcome at the festivities. The topic for Technology Day 1991 is "Sex, Drugs, Genes, and Obesity—The Impact of Molecular Biology on Your Health." If you are interested in more information about the program, please call the Reunions Office at (617) 253-8230.

The second piece of information is from **Joe Forgione**. He wants to let us know that he and some others have founded a new software company, HyperDesk Corp. The group bought out a project from Data General, and, with funding from ASCII, set up the company in Westboro, Mass. Joe also reports that his son, Michael, is actively involved in a number of sports already, and he has real potential in soccer. Joe says that Michael is very fortunate to have one of the best coaches in the league—Joe's wife, Maria.

Here in Springfield, Brielle, Kellen, and Joia are growing, learning, and continuing to be a great source of joy to Paul and me. We look forward to hearing about you. Please drop a note to me, **Ninamaria Maragioglio**, secretary, 8459 Yellow Leaf Ct., Springfield, VA 22153-2522; e-mail to hertz@ccf3.nrl.navy.mil.

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It is my sad duty to report the death of **Harry Gammerdinger**. Harry died in October of last year. After receiving his degree in humanities from the Tute, Harry received a doctorate in folk

lore from Indiana University. At the time of his death, he was a professor of mathematics and English at Memphis State University. Harry is survived by his wife, Kathryn, and two siblings.

Jeff Held writes, "My wife, Mary, and I had our first child, Laura Katherine." Jeff and family are living in Fairfax, Va.

While rooting through last year's *Yankee* magazines, your secretary discovered an article about "The Big Mouth of Fenway Park," none other than our classmate, **Paul Lagace**. Paul's sustained 20-second howl, "W-A-A-A-D-E!!!" when Wade Boggs steps up to the plate has gained him quite a lot of fame at Fenway Park. Paul teaches aero/astro at the Institute and has a particular dislike for students who are Yankee fans. At our 10th reunion, Paul showed classmates the limited-edition baseball card with his visage on it.

After reading about himself in this column, **Ron Neifield** sent a note to fill in the gaps left out of the company press release that told of his new position. "After seeing the sordid details of my professional life in the last issue, disclosed through some unknown source, I thought it appropriate to write with some of the more important details of life. Robin Weiner (Wellesley, '81) and I married in the fall of 1980. After finishing law school and practicing in Chicago, we moved to Philadelphia in 1985. We have three children, Harris (4), Brent (almost 3), and the prettiest little girl in the world, Zara, who was born last May. Her brothers are working hard to turn her into another little monster. Robin and I are still sane, although this condition may not continue for long."

Mark Dershowitz brings us up-to-date on his news: "My wife, Hindie, and I had our first child last year, daughter Lisa born in June 1990. The baby is starting to crawl now, which brings new meaning to the importance of baby-proofing the house. Before Lisa, Hindie and I managed to do some exciting vacation traveling. Over the last five years, we have been to Europe, Australia, and New Zealand, and we have taken three trips to different parts of Canada. I'm still working for Shell Oil Co. in my fifth assignment in almost 12 years."

Meanwhile, your class secretary and wife, **Diane Curtis**, have been designing our new home on the farm, and should be building it as you read this. . . . Please send news of yourselves. And, for those of you who hesitate to put pen to paper, I'm adding our telephone number. Please call.—**Jim Bidigare**, secretary, 322 Central Ave., Newark, OH 43055, (614) 345-8582

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Deb (McKechnie) Mossman sent me a postcard from Budapest, where she was on a research development visit last November, funded by the National Academy of Sciences. She reports, "My collaborative discussions are going well. My host is very vocal about his political views and is a very interesting fellow, so I get to hear about the Socialists and Russians. The city is beautiful but the air pollution is bad, and my command of Hungarian is even worse." . . . **Claude von Roesgen** married Angela Nannini on Memorial Day weekend last year. He has also been in touch with a number of alumni. "Helped Joe Rice, '80, install central vacuuming in his two-family here on Belknap St. Dave MacAllester, '78, lives within one block over on Freeman St. I'm also working with Peter Cheimets, '78, on a Honda CVCC Civic 81. We've pulled out the engine, radiator, exhaust, and gas tank. We're installing an 11 horsepower series wound traction motor and batteries. Peter and his wife, Karen Benedek, '85, are expecting their second child. Their first, Ana, is almost 3 years old." . . . Also recently wed is **Mark Stern**, who lives with his new wife, Sharon Burkhoff, in Hartsdale, N.Y. Mark commutes north to Connecticut for his job as a business practices advisor for IBM Credit Corp., while Sharon commutes the other way to New York

City, where she is a pharmacist.

Dave Westenberg and his wife, Nancy (Wellesley '80), live in Wellesley, Mass., with their infant son Matthew (16 months old at last communique). Dave is a partner at the law firm of Hale and Dorr, where he specializes in securities, intellectual property, and venture capital law. . . . **Laura Lau-Peterson** lives in Tampa, Fla., and works at GTE Data Services in artificial intelligence. She is the mother of 8-year-old Marina and also serves as an MIT educational counselor and vice-president of the MIT Club of Tampa Bay.—**Sharon Lowenheim**, secretary, 98-30 67 Ave., Apt. 6E, Forest Hills, NY 11374

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Keith A. Thompson of Van Nuys, Calif., was promoted to vice-president at Thompson Consultants International (TCI), an airport terminal consulting firm. . . . **Thomas Klein** is also a vice-president at Optical Filter Corp. in Natick. . . . The Greenfield, Mass., *Recorder* reports that **David Damery** has been named director of marketing at Rugg Manufacturing Co. He is also a member of their board of directors. David and his wife, Connie, have a son, Benjamin.

Send your news to: **Kim Zaugg**, secretary, 2384 Leslie Cir., Ann Arbor, MI 48105, (313) 665-2365, vayda@drs4330b.erim.org.

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10th Reunion

Hello everybody! This column is scheduled for publication a few weeks before our 10-year reunion. I look forward to seeing many of you at this big event. The Alumni/ae Association has asked me to remind you that Technology Day is Friday, June 7. The title of the program is, "Sex, Drugs, Genes, and Obesity—The Impact of Molecular Biology on Your Health." All classmates are encouraged to attend.

I received several pieces of mail from classmates during the past month. **Annie Murray** wrote that she and husband Gustavo de los Reyes, '80, are enjoying life in Fair Haven, N.J. Annie and Gus are the parents of Alicia and Erik. Annie is enjoying being a full-time mom while Gus works for Bell Labs in Molndel. . . . **Dave Kates** was married in March 1990. He is currently developing computer applications for the hospital industry and hopes to start a firm in 1991. . . . **Cameron Dryden** is a digital project manager for United Technologies Optical Systems in Cambridge. He recently developed a machine vision processor chip and board. He claims that the most demanding project for him and his wife, Theresa Ferguson Dryden, '82, are their sons John, age 3, and Paul, born in July 1990.

Chuck Markham has started his own accounting and tax-consulting practice, catering to individuals, small businesses, and not-for-profit organizations. Chuck was previously with John Hancock Ventures. . . . **Anitta Bliss** is enjoying life in San Jose where she is a project manager at Apple. Aside from work, Anitta spent a three-and-one-half-week vacation last spring in Europe. She particularly enjoyed the Swiss Alps, French food, and theatre in London. . . . **Kent Curtis** recently moved to Four Pi Systems Corp. as director of software engineering. The company designs and manufactures a line of printed circuit board inspection equipment.

Michael Baylocc enjoyed spending a couple of years working for MATRA ESPACE in France. He returned to the Bay Area in October and is currently working for Space Systems/LORAL on weather satellites. He highly recommends the international work experience. . . . **Paul Tesser** received both MD and PhD degrees in May 1991 from the State University of New York at Stony Brook. Dr. Tesser will pursue a residency in ophthalmology.

Nora Fong, MD, is finishing her first year of law school at the University of California at

vis. Her winter vacation included visiting Mexico's Yucatan and skiing at Aspen. . . . Ned and I just returned from an exciting ski holiday in Utah. Eric visited with his grandparents while we were away, making it a very relaxing vacation. . . . Please keep the cards and letters coming. See you in June.—**Lynn Radlauer Lubell**, secretary, 2380 Northwest 41st St., Boca Raton, FL 33431

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Please send news for this column to: **Stephanie Pollack**, secretary, 135 Sutherland Rd., Brighton, MA 02146

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Michele (Devereau) Gaudreault is a PhD candidate at the Air Force Institute of Technology in Dayton, Ohio. She writes that she recently finished Squadron Officer's School, which included seven weeks of miserable humidity in Montgomery, Ala. Michele has a 1-year-old daughter, and her brother, a marine in Hawaii, is currently in Saudi Arabia.

I received a copy of an article in *Savvy* magazine highlighting the accomplishments of **Anita Flynn**. Anita works in MIT's Artificial Intelligence Laboratory. Her mobile robotics group is creating robots that "learn" to coordinate their movements. Currently, Anita has an inventory of robots that can climb walls, retrieve soda cans, and cross country ski. Word has it that her latest project is to create a robotic cow that can climb the stairs to Barker Library but will have to be removed by crane (even AI robotic cows don't go downstairs).

John English called with some information on some SAEs. **Todd Huffman** works for Spectrophysics in Corvallis, Ore. He and his wife are expecting. . . . **Steve Lubiak** works for Johnson and Johnson in Medfield. . . . **Morris Keesler** works at the Georgia Tech Research Institute, setting up their laser lab.

Please write in to tell us what you are doing.—**Jonathan Goldstein**, secretary, TA Associates, 45 Milk St., Boston, MA 02109

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The Technology Day Committee announces that the topic of this year's Technology Day program will be: "Sex, Drugs, Genes, and Obesity—The Impact of Molecular Biology on Your Health." Of course, this notice is a little last-minute for the June 7th program (given the lead time on producing these columns), but all alumni/ae are invited back to enjoy spring at MIT and an interesting program.

I know you were all looking forward to the report on the seventh annual Baker and Associates New Year's party, which was hosted by DanO, '85, in Santa Cruz. Alas, this will be delayed to next month. However, I can report that the all-afternoon/evening sushi bar was crowded with happy patrons.

Michael Schlein is working as the director of economic development projects for New York City. He works with Mayor Dinkins and the deputy mayor to promote the city's economy and to attract and retain businesses in New York City, a very challenging and exciting job. . . . **Stuart Gitlow** finished his second year of psychiatry residency and is also almost finished with a master's in public health. He bumped into **Glenn Fleisig** at their 10th high school reunion. Both were happy to see that, unlike their classmates, the MIT contingent was neither bald nor paunchy. Must be that Charles river water.

David Brahm graduated from Berkeley and is postdocing in particle physics at the other technical school in California. However, MIT is well represented there. David's colleagues include Dave Montano, '85, John Feiler, '86, Eric Raiten,

'86, Keke Li, PhD, '89, and Murray Gell-Mann, PhD, '50. No wonder their reputation is so good. . . . **Mark Radlauer** loves it in Colorado. He joined numerous Fijis and other friends for a ski week at Steamboat. Mark is living with Art Gregory, '87. Reported activities are skiing, biking, hiking, and climbing (with work conspicuously not mentioned).

Kim (Coldwell) Worley dropped me a line that was not intended for *Tech Review*, but I think I can mention a few things. Kim is a grad student at Baylor College of Medicine in molecular genetics. She has passed the quals and is well into her research. Frank and Kim keep busy with their house, a continual source of entertainment.

Finally, a note to Lee Fortunato (and any other confused people.) I am not the Howard that Robin Larsen, '86, married. I married Lori Brill, '85, Robin married Howard Stearns, '86. Lori and I recently saw Howard and Robin, and after dinner we played a little bridge. Needless to say, the potential for partner switching was enormous.

From Boston or thereabouts—**Howard Reubenstein**, secretary, 28 Mitchell Grant Way, Bedford, MA 01730; (617) 275-0213 (home), hbr@mitre.org.

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Hi there, everyone. First some serious news. I have received word that one of our classmates is currently serving in that cauldron of discontent known as the Persian Gulf. **Pat Peters** is flying A-10s. He can be reached at: 1st Lt. Pat Peters, SS#382845361, 354 TFW/355 TFS OPS, APO NY 09855. Pat married a woman named Rachel in March of 1990. . . . **Captain David Sizoo** is also an A-10 pilot and may be sent to the Middle East at any time. David's older brother, Michael, also an MIT alum, is the pilot of a C-141 Starlifter, which has made several trips to Saudi Arabia. Let's hope for their speedy and safe return to terra firma, USA.

Along with the news about Pat above, **Michael Bernard** says that he and Julia Hsieh '89, recently got together with **Megan Donahue** and her husband, **Mark Voit**. Megan successfully defended her PhD dissertation last August, and now she and Mark have jobs associated with Caltech doing astrophysics. They are the proud parents of a white Siberian husky named Sierra. Michael recently transferred from the Dynamics Department at TRW to the Systems Engineering Department in TRW's Military Space Systems Division. He is now spending a lot of time on SDI related work. In addition, he is involved with the MIT Club of Southern California, with the American Institute of Aeronautics and Astronautics (AIAA), and with writing a book for recent MIT graduates, *First Year Out*.

Paul Boutin left his heart in San Francisco last year, and in January the rest of him followed. Besides being part owner of a startup company, he is working on an MBA while collecting crystals, practicing his homemade bamboo flute, writing haiku for the Sierra Club, and taking vegetarian cooking classes. . . . **Alec Atkin**, not satisfied with the usual temples, shrines, and castles itinerary, recently showed **Bob Ungar** a side of Osaka not normally seen by tourists—love hotels, hostess bars, and dial-up "companion" girls. . . . **Jim Hutchinson** and Anne Fricker, '86, recently returned from a trip to New Zealand. The scenery was great, the people friendly, the traffic nonexistent, and best of all, lots of sheep.

John Ragan completed a PhD in chemistry at Harvard in May 1990. Since then he has been at UC/Berkeley as an American Cancer Society post-doctoral fellow. He reports sighting several other Phi Betes in the area: **Ron van Veen**, **Jaime Guillen**, **George Fan**, and **Lelan Mah**, '83. . . . **Adam Brody** became a member of AIAA Space Operations and Support Technical Committee. He has run into lots of people from the MIT Space Systems Lab at conferences including: **Joe Parrish**, **David Stuart**, **John Spofford**, **Cliff Kurtzman**, **Dave Anderson**, and **Lisa Rockoff**. . . .

Hisaya Sugiyama has been working for the design firm of Kohn Pedersen Fox for the last one-and-a-half years. Currently, he is working on construction documents for the last high-rise office building at Rockefeller Center, and, starting in 1991, he will be involved with some projects in Japan.

Still studying and still one step ahead of the post office, **Bill Messner**, secretary, 520 Key Blvd., Richmond, CA 94805, (415) 237-3795, internet: messner%cmlds6@ucbarpa.berkeley.edu.

86 5th Reunion

All my whining has paid off. I received five letters! It must be a record. Thanks to all of you who wrote in. Technology Day (June 7, 1991) will include a program, "Sex, Drugs, Genes, and Obesity—The Impact of Molecular Biology on Your Health." There will be several speakers and panel discussions on the clinical and ethical issues raised by the research. For more info, contact the Reunions Office at (617) 253-8230.

A special note to all our classmates serving in Desert Storm: we hope you are all well and come home safe, especially **Captain Noel Zamot** (who is the only one I know who's actually over there). Noel is deployed indefinitely as an electronics warfare officer on the B-52, stationed out of Griffiss AFB, New York. . . . **Captain Rich Maurer** is also at Griffiss and was lucky enough to do his time in Saudi Arabia before the holidays and return home to keep up the fort. . . . **Captain Karl Tucker** will be leaving the Air Force soon. He's been accepted into Harvard Business School, so he'll discard the blue polyester for corduroy (do they still wear corduroy there?)

Margaret Burke started grad school for a History of Science degree in the fall of 1986 but dropped out to begin work at the U.S. Patent and Trademark Office, where she's been ever since. She examined mainly superconductor cases for the past two years but filings in that area slowed, so she picked up thin/thick films for electronic devices. Margaret also started law school at night and now only has about a year to go. She must be very busy because she also has an adorable 2-year-old daughter, Catherine Anna.

Anthony Scotti is at George Washington Law School and is living with **Bismarck Emineth** in Washington, D.C. . . . **Walter Santarelli** entered the PhD program in the fall of 1989 at UPenn Department of Computer and Information Science. He planned to spend five years there and either return to work or remain in academics. However, funding for research positions was overextended, so Walter could not get a research position in the robotics lab. Therefore, he completed a master's and returned to work at Boeing Commercial Airplanes in November 1990. He is currently working on the 777 primary flight computer. . . . **Ed Kriegsmann** received a JD from UPenn School of Law and practiced patent in Washington, D.C., at Finnegan, Henderson, Farabow, Garrett & Dunner. He has just returned to Framingham, Mass., with his wife (Meryl Dennis, '88) and their six-month-old son, Barry. He joined his father's law practice there, **Kriegsmann & Kriegsmann**. Ed hopes to concentrate in biotech and chemical patent law.

Lee Newburg spent two years at Microsoft doing graphics and then decided to take a leave of absence to get a master's at UC/Berkeley in computer science. Lee is just about finished but has decided to go on and get a PhD, which means another two more years at Berkeley. . . . **Gina Buccellato** is also at Berkeley getting her PhD. . . . **Ban Leng J. Toh** started work for an MBA at Wharton in January 1991 after being in Singapore working for Booz, Allen & Hamilton. . . . **Gordon Shaw** returned to the East Coast to attend Columbia Business School in January 1991, also. . . . **Ray Schmitt** also attends Columbia Business School while working at JP Morgan. Please note: In past issues, any time **Karen Wohl**, **Ellen Epstein** or **Anne Fricker** was mentioned, Ray

Schmitt was also involved and his name was unfortunately left out (writer's block?). Sorry, Ray, it won't happen again.

Chris Medina finished his four years in the Navy in June 1990 and now lives in LA with his wife, Karla. Chris is working for the West Coast Division of Shell Pipe Line Corp. in Anaheim as an electrical engineer. He says it's a lot different than the Navy: he works 7-4, gets weekends off and doesn't have to stand duty. You should have joined the Air Force, Chris! . . . **James Person** also separated from the Navy and was planning on attending the University of San Diego for a master's in international business.

Finally, **Karen Wohl**, **Ray Schmitt** (see!), myself and my hubby spent a pitiful weekend at Lake Tahoe over Martin Luther King weekend looking for snow. We ended up gambling too much and watching too much football, but still had a great time. Maybe we'll head to Taos in March where I hear snow has been sighted!

Thanks for all the news. Remember the reunion in June.—**Mary C. Engebretsen**, secretary, 1805 Manhattan Ave., Hermosa Beach, CA 90254, (213) 376-8094

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And now, for the latest updates on your fascinating classmates. . . . **Tom Devlin** received a master of design degree in industrial design from the Royal College of Art in London in June 1989. He then worked independently as a designer in London for nine months. In May, Tom returned to Boston and began working for Product Genesis in Cambridge, an engineering and product design consultancy staffed by many MIT folks. . . . **Emilio M.D. Lopez, Jr.**, wrote in to announce his new job at Chemical Corp. as an applications engineer for the central region. He troubleshoots customer process problems. Emilio is working out of his home in Garland, Tex.

Jeffrey Kent wrote in from Seattle, Wash. He is employed by the Boeing Co. as an aerodynamicist. On November 3, he was married to the former Miss Nancy Andrews of Sumner, Wash. She has graciously consented to support their household for the next eight years while Jeffrey attends medical school at the University of Washington. **Michael McElroy** and **Michael Decker** were in attendance for the wedding. . . . **Walid Nasrallah** wrote in from Cambridge, Mass. "The last time I wrote I said I was helping build a palace for the Emir of Kuwait. Most of you did not know who the Emir of Kuwait was. Now I'm sure more of you know who he is, but he will probably not be needing a palace anymore (at least for a while)." Walid is now living near MIT (homesickness, he supposes) and is trying to start a business.

Greer Tan sent in some e-mail. It goes like this: "The Young Alumni Social Committee recently had a picnic for MIT graduates of the past 10 years. . . . I pulled **Rob Swiston** and **Toai Doan** to come along with me for a fun brunch up in Portsmouth, N.H. We, of course, spent more time on the road than actually at the picnic since it was over an hour-and-a-half drive, but we had fun, bumping a volleyball and playing some frisbee.

"I am also active with the Boston Chapter of the Society for Women Engineers. In fact, I am the chair of the Job Bank, trying to do a little matchmaking between corporations and SWE members who are looking for a change. Trying to provide a 'facilitating' service. . . it's been fun.

"This past summer, I was on a steering committee for the campaign to elect Dan Lam as the state representative for Norfolk District Six in Massachusetts (that's my district), which has launched me into a more active role in my community.

"Let's see. . . the only other news is that **Rob Swiston** has bought his first townhouse in Marlboro, Mass. (to close in November). He still works for FASTech, a start-up company in

Waltham that is doing very well. They have recently gotten into the black and are on the wonderful yellow brick road of success.

"Oh... here at Encore I bumped into two MIT types, George Wang ('88, '89) and John Sheffield ('86)."

Alright gang... now it's your turn. Send in those letters!!! Write me at—**Stephanie Levin**, secretary, 393 West End Ave., Apt. 8B, New York, NY 10024; (212) 595-3172

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Although I haven't heard from any of our classmates that may be out in the Persian Gulf, we just want to let you know that we are thinking of you and awaiting your safe return.

Speaking of the war, **Chad Raymond** started working for the DEA on the West Coast on January 14, then went to Quantico, Va., in March for 12 weeks of training in weapons, demolitions and guerrilla tactics. While he was waiting for the hiring freeze to be lifted last fall, he spent three months in Corpus Christi, Tex., selling Mitsubishi cars. He came back to New England for the holidays and found Boston to be "utterly depressing with banks failing left and right and several homicides." . . . Navy Ensign **Burl Amsbury** was designated a naval aviator on December 19, 1990. He was presented with the "Wings of Gold," a mark of culmination of 18 months of flight training. Congratulations! . . . **Mark McDowell** was commissioned a 2nd lieutenant in the U.S. Air Force after graduation in 1988. He remained at MIT in the VI-A program to receive a master's in electrical engineering and computer science in June 1989. A month later, he reported for active duty at Los Angeles Air Force Base. In the past year, he got engaged to Laura Papero (Wellesley, '90) and was promoted to 1st lieutenant. He says he has seen many friends from the "Tute," especially playing volleyball in Manhattan Beach.

Marty Scheidl will be moving to Washington, D.C. He's going to start a gourmet bakery business featuring popovers and sweetbread. Sounds wonderful! . . . **Satish Lathi** and his wife, Amy, have a happy home in Atlanta, where Satish does civil engineering for a construction firm. They are expecting the birth of their first child in late June.

Dave Glassner is still working on a PhD in physics at USC. He has found time to form a bowling team called "The Skinheads" with Greg Harrison, '86, and Ray Covert, '86. Dave's wife, Michelle, is the star of the team. . . . **Evan Hansen** has reportedly quit his job in Boston and bicycled to Florida to see his grandparents, then headed west to New Mexico to link up with "Extraterrestrial Life Foundation," a group that researches UFO sightings. (Disclaimer: I only report the information that I receive and have no way of verifying this!)

Ryan LaPlante is now living in Manchester, N.H., where he works as an independent software consultant. His latest project is designing an inventory tracking system for a New England meat trucking company. He recently caught up with **Mike "The Walrus" Strange**, who lives in Arlington, Mass. Mike works for Cambridge Technology Group and breeds Russian wolfhounds in his spare time (disclaimer holds for this piece of info too).

Marcia France completed a master's in chemistry at Yale University, "hating every minute of the two long years she spent there," and is now in a PhD program at Caltech. She claims life there is "infinitely better" and that she is even enjoying herself! . . . **Mark Hanson** is studying for a doctorate in aero/astro at Nassau Langley and George Washington University in Virginia.

Daniel Ohanian is currently working for a consulting engineering firm based in New York City. He is working on a highway project located in Brooklyn. . . . **Omar Masurur** writes from Pakistan with a special "hello" to **Nazhin Arghamee**, **Bill Johnson**, **Francis Cissna**, **Chan Yoon**, **Eugene Opsasmik**, **Jan Koeman** and

KoKo. He says he misses the university scene tremendously.

Our class president, **Lisa Martin**, is still working for Dunn and Bradstreet and starting to plan our 5th reunion. If there are any of you out there interested in the position of reunion chairman, please contact her or let me know (address at the end of this column). Lisa went to an MIT ball held at the Boston Museum of Fine Arts to honor the new president, Charles Vest. Among the many alumni/ae who attended, she ran into Brian Lasher, '89, Hyuna Park, '83, and Ed Rubesh. About our other class officers, **Debbie Lee** is living and going for an MBA in Texas. . . . **Kimber Lynn Zinger** is working and living in the Boston area and has been involved in a number of theatre productions including *A Chorus Line* and a satire on Donald and Ivana Trump. . . . **Erik Heels** is back in Boston working in an acquisition project management at Hanscom Air Force Base. . . . **Tracy Gabridge** is now living in Colorado after receiving a promotion at AT&T. She is enjoying the skiing out there.

I ran into **Young Shin** and **Joe Woo** at *Rascals* in Manhattan in the beginning of January. Young is still working for Morgan Stanley and took a short Utah ski vacation at the end of January. Joe is a third year student at UPenn Medical. He is enjoying himself and headed towards cardiovascular surgery. All you other med students out there, I'd love to hear about your rotations and what you are interested in specializing in. Also, I'd just like to remind you that my columns are due three months before they are published, so much of the information I relay is outdated by the time it is in print. Sorry about it!—**Grace Ma**, secretary, 545 E. 1st Ave., #9H, New York, NY 10016, (212) 545-7950

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For the last two years, we have been receiving complimentary copies of *Tech Review*, but now our free subscriptions are close to expiration. However, a \$25 donation to the Alumni/ae fund will enable you to continue receiving the excellent articles in *Tech Review* in addition to our class insert, so please keep in touch by supporting our Class Scholarship, reading our class notes, and sending news!

I have to start out by correcting an error in the Nov./Dec. issue. It seems as if I have gotten **Lindsay Haugland** confused with the bionic woman. Sorry. (As I mentioned, errors generate mail, but, really, this wasn't intentional!) She has been living north of Kyoto in a house with two-inch cockroaches, which allow her Kafka-esque contemplation at 4 in the morning. Other than that, Lindsay reports that Japan is mighty fine. Lindsay will probably be in Japan through the end of July, where she will work a lot more on her Japanese.

The packet of goodies came this month with lots of little slips of news (from all the people who are renewing their subscriptions, presumably!) . . . **Mona Caesar** is currently in the army doing environmental engineering work for the U.S. Army Environmental Hygiene Agency at Aberdeen Proving Grounds, Md. . . . **Heather Huber** is working for IBM in Raleigh, N.C., and is making plans to start grad school next fall. . . . **Forrest Chang** is a communications platoon leader at Camp Pelham, Korea. . . . **Eric Sadler** recently started a new job as a design engineer in New Jersey. . . . **Hashi Charkravarty** and **Mike Saulnier** are now engaged. Hashi is working for HP in Andover, and Mike is at Harvard working on a PhD in Physics.

Darian Hendricks is living in Boston. He has recently founded the MIT Leadership Foundation and is also the treasurer of BAMIT. . . . **Barbara Roman** spent the 1989-90 school year in Chicago in a one-year certificate program at the school of the Art Institute of Chicago. She studied computer graphics and also did some holography. Now back in Cambridge, she is working at MIT

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as a researcher in computer graphics. . . . **Michael Malek** who is out at Caltech, recently appeared in the production of *Rosencrantz and Guildenstern are Dead*. Also in the production were **Ernie Prabhakar**, '88, and **Brian Rague**, '86. . . . **Steven Kishi** is a configuration designer for the National Aerospace Plane (NASP) project at McDonnell Douglas in St. Louis.

Stacy Swider and **Chris Schalick** are "still being spastic Silicon Valley types." Chris is on his third job in a year and Stacy switched jobs in December. Chris is presently working as a digital designer for Epron America, and Stacy, who used to be a "lab rat at SRI International" is now working at CVD Diamond start-up called Crystallume. They are both still playing music and jam almost weekly with new California friends. . . . **Laura Brauer** is working for GE Aerospace in Princeton, N.J., while pursuing her MS in mechanical and aerospace engineering at Rutgers. She is a member of the propellant loading team for satellite launches from French Guiana. Her first trip there was last October for the GSTAR-4 (US Sprint) launch. . . . **James Sole** received his "wings of gold" after finishing an intensive Navigator Training Course at Mather Air Force Base in Sacramento, Calif. James has now been designated a Naval Flight Officer.

I saw **James Worden** and **Anita Rajan**, '90, at the Museum of Science, where they were displaying prototype solar cars built by their company, Selectria, during the Museum's special exhibit on energy conservation. . . . **Andy Singer** wrote with more news of his engagement to **Cathy Suriano**, '88. They will be married in August. Cathy recently completed a master's at Columbia. Andy will be finishing a master's this term. Andy plans on continuing working towards a PhD in the Digital Signal Processing Group here. Andy is a teaching assistant for Professor Oppenheim's DSP class this term. . . . Andy also sends news that **Jeff DeRosa** is at Berkeley working on a master's degree in mechanical engineering. . . . **Dave Miller** is working in New York for Sithe Energies, where he shares an apartment with **Beth Green**. Beth is engaged to **Byron Shaw**, who is a grad student at MIT. . . . **Maria Kojic** is leaving the country. . . . **John Buck** will finish a master's in the Digital Signal Processing Group in June after which he plans to teach high school.

Andrew L. Yee is pursuing his PhD at Northwestern University in material science in Chicago and, having been chosen as the designated reporter, further reports that: **Bernard Lee** is pursuing a PhD in material science at Stanford, not working at IBM as previously reported. . . . **Scott Weir** is fulfilling his ROTC requirements in Portland, Ore., for the U.S. Navy. . . . **Phil Won** and **Kevin Coleman** are working for Ford Motor Co. in Dearborn, Mich. . . . **Michael Chung** is an Ohio State University medical student by day and star volleyball player by night. . . . **David Wang** is working as an actuary for a New York firm whose name escapes me at the moment. . . . **Nancy Wang** is working for Price Waterhouse in New York. . . . **Tom Barraza** is a software quality control engineer at Pitney Bowes in Conn. . . . **Yong (Kato) Han** is a Tufts medical student. . . . Also, in order to revive the tradition of a taking of yearly ski trip together as Andy, Bernard, Scott, Phil, Michael, David, Nancy, Tom, and Yong did while at MIT, they were planning to meet at Lake Tahoe in mid-January for four days of skiing, gambling, eating, drinking and all-around good fun. Hopefully Andy will write of the outcome of that trip.

Hugo Ayala is still working at Apple Computer, and has recently applied for a patent for computer graphics. Hugo also sends along news about some buddies from PBE: **Nick Newmann** is living in Brookline, Mass., and is working at a hospital there doing health research. . . . **Jay Best** is now married to Sharon (Smith) Best. Jay is working for a chemical company somewhere near Boston. . . . **Gary Gruberth** is now married to Corey Gruberth and continues to work for MIT. . . . **Craig Giordano** is attending law school some-

where in the Washington, D.C. area. . . . **Ed Chang** is attending Harvard Medical School. . . . **Doug Chu** is attending grad-school (Aero-Astro) at Princeton. . . . Hugo goes on to write that, "Other people in our class that I have no clue what they are doing are: **Marc Jorrens**, **Peter Wong**, and **Ted Johnson**." (Even if you're not among these people, let's hear from you!) Hugo was spotted by **Ronald Koo** attending a reception which the Northern California MIT Club held for President Vest. Also attending the reception was **Greg Belaus**, '88. The reception was held at Genentech, courtesy of Bob Swanson.

Jerome Braunstein is at University of California at San Diego studying for a PhD in mathematics, specializing in numerical optimization. Jerome just earned a master's in applied mathematics. During vacations he works on a yacht, and just came back from winter break in Mexico. Jerome is also on the school ice-hockey team. He plays defense and started one game against Caltech. The UCSD team did not beat Caltech by as much as MIT usually does. They play other west coast teams in the Pacific League. Unfortunately, Jerome was out for a few months due to a knee injury that occurred in their first game in the San Diego Sports Arena. Also in the math department there are **Arun Ram**, '87, **Joe Alfano**, '88 and **Sara Billey**, '90.

Sharon Belville writes that she was honored to be one of the bridesmaids at the wedding of **Javier Casas** and **Glendora Conrad** on October 27, 1990. Other MIT folks in the wedding were **Peter Rothschild** (MIT G), **Ethan Wenger**, '92, and **Mark Wintersmith**, best man. **Javier** and **Glendora** honeymooned at Disneyworld and are living in Haverhill, Mass. Among several MIT folks attending the wedding were **Debbie Falcone**, who is working for HP still. Sharon is at Project Athena writing documentation.

Sam Peretz will be returning to MIT in September for a bachelor's degree in electrical engineering, and will also be applying to the VI-A (co-op) program. Experimental neuro-science is out, neural networks are in for Sam. Sam hopes to be working in the New Jersey area over the summer, hopefully at Bell Labs, though that isn't confirmed just yet. . . . Since graduation, **Shelley (Good) Rueger** has been working in the MIT financial aid office heading up student employment. Shelley just got married to **Timothy Rueger** who will be getting an MS in EE in June. They are currently living in Westgate. Shelley is also the secretary of the Alumni Board of MIT Student House.

Susan Streisand is in the PhD program in electrical engineering at Berkeley, along with **Mike Williamson** and **Judy Chen**. Sharon reports on the following in California: **Jessica Hirschfelder** is almost done with an MS in nuclear engineering at Berkeley. **Tim Kao** is working on an MS in electrical engineering. **Eric Andersen** (also at Berkeley in electrical engineering), **David Blackston** (computer science at Berkeley), **Salma Saeed** is getting an MS at Stanford, **Tim Eicher** is working for Oracle, and **Andrew Brabson** is training to be a navigator for the Air Force somewhere near Sacramento.

Sam Hou is now at Stanford after recently finishing an MS at MIT. **Sam, Jason Nieh**, and **Eric Ordentlich** all took the qualifying exams in January, after which Eric took a vacation to Disneyworld in Orlando. Sam misses IAP, but is enjoying the wonderful weather, and has been taking a lot of pictures.

Thanks for all of the news this month and please keep on writing! And all those people without e-mail please send some U.S. Mail!—**Henry Houh**, secretary, 14 St. Paul St. #1, Cambridge, MA 02139, (617) 661-1691, e-mail: tripleh@athena.mit.edu

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Max Ochoa writes that he is a graduate student in aerospace engineering at the University of

Michigan in Ann Arbor. While recently traveling in California, Max ran into **Andrew Knoedler**, **Alissa Fitzgerald**, and **Keoki Jackson**, '89. Also at the university are **Alex Chen** and **Tony Lujar**. . . . Andrew is finishing up his Course XVI EIP at JPL. He'll be back at MIT in the spring along with **Susie Wee**, who is finishing up her Course VI EIP at JPL, and **Julie Ask**, who is finishing up her Course VI EIP at COMSAT. . . . Other people back at school. . . . **Jenny Schneider** is continuing her studies in economics. . . . **Harry Huang** is at the University of Pennsylvania Medical School. . . . **Dave Berners** is at Caltech. . . . And **Elee Meyer** is at Stanford.

Charrissa Lin, **Alissa Fitzgerald**, **Yvonne Grierson**, **Beverly Saylor**, and **Fred Kennedy** share an apartment in Davis Square. They are all graduate students at MIT. . . . Beverly is currently conducting research in the Mojave Desert. . . . Congratulations to Yvonne! She won the Outstanding Female Athlete of the Year award (in Division III) from Honda. . . . Engagement/wedding announcements. . . . **Kelly Savage** is engaged to **George Roscoe**, '89. . . . **Luisa Contreiras** is engaged to **Joe Heanue**, '91. . . . **Chris Fennema** is engaged to **Randy Noteline**, '89. Chris and Randy are planning for an August wedding in Minnesota. . . . In June, **Harald Weigl** and **Shirley Lee** were married.

In January, at the Boston Museum of Science, **Anita Rajan** and **James Worden**, '89, were busy displaying two prototype solar cars from their company, Selectria. Also present was **Derek Rutherford**, who was showing MIT's solar car. This was the car driven across Australia by James Worden, '89. . . . **Eriko Yagi** is working and studying in Tokyo. . . . Also out in Japan is **Ken Bergenthal**. Ken writes that he has been having a great time working there. He is programming in C for Mitsubishi. Ken lives in an apartment about one and a half hours from Tokyo. In his same apartment building are other foreigners who work for Mitsubishi. . . . **David Plass** writes that while he and **Shella Farooki** were in Boston, they visited **Al Canguhuala**, '87, **Dave Martin**, **Wendy Yi**, '92, **David Tabak**, **John Ma**, and **Bret Harsham**. John, Bret, and **Lalit Jain** are sharing an apartment in Boston.

Julia Drewry and **Owen Harrod** both recently came back from England. Julia was working in Bath at an architectural firm and Owen was taking classes.

Congratulations to **Rachel Harmon**. Rachel has just been awarded the Marshall Scholarship. She plans on studying political science for two years at the London School of Economics. Only 40 scholars were chosen from over 800 applicants. Rachel is currently working in the Manhattan Borough President's Office as a New York City Urban Fellow.

In January, I saw **Desmond Davis** and **Steven Shen** in New York City. We all took a two-hour lunch and caught up on some MIT news. Desmond was in town from Boston (McKinsey & Co.) for a meeting and Steve was in town just to relax. He had just finished up a month-long assignment for Ford in San Francisco. Next for Steve is a two-month internship at the Boston District Sales Office and some development and testing work in Florida.

Just a reminder for people who are planning their vacations already. . . . Friday, June 7, will be Technology Day at MIT. The title of this year's program is "Sex, Drugs, Genes, and Obesity. The Impact of Molecular Biology on Your Health." This program has been planned by the biology department in order to highlight the molecular biology research being done at MIT. The speakers will cover the following topics: "Human Genetic Diseases and the Human Genome Project," "Atherosclerosis and Heart Disease," "Immunity and AIDS," and "Human Cancer."

Don't forget! Send news about yourself and your classmates to me, or else you won't be reading much in this column. Thanks.—**Ning Peng**, secretary, 409 Argyle, Mineola, NY 11501, (212) 745-2704 (w), or (516) 877-0444 (h)

Lawrence Lidsky, PhD '62

Nuclear Engineer & Icon Basher

By Debra Cash

There's an "Ask Dr. Science" sticker on the wall outside Lawrence Lidsky's book- and paper-clogged office in Building 38, and his Dr. Science coffee mug is somewhere at home. But this Dr. Science would be well pleased if everyone asked him some tough questions and refused to take the answers at face value. "Experts are worrisome," he says. "Experts tell you all the things that can't be done, because



they couldn't do them. They tell you that there are no shortcuts, no simplifications." He leans back in his chair and shrugs. "The day is long gone where you can say, 'I'm a scientist, trust me.' I mistrust experts myself, and, yes, it made me nervous when I became one."

Approachable, comfortably disheveled, and blessed with an ability to skewer his own self-importance—he has often attributed his career interest to the fact that physics involves no heavy lifting—Lawrence Lidsky believes that his tenure as an MIT professor of nuclear engineering was a gift of freedom. Honoring this hard-won prize requires him to use its prestige to follow his convictions.

In 1983, following his convictions meant saying in print, in the pages of this magazine, what he had argued privately for years: that the Department of Energy and the Nuclear Regulatory Commission had taken the wrong road on nuclear reactors.

That the atom might, indeed, be the source of nonpolluting energy that industrial dreams are made of, but that American reactors were doomed to accident and well-deserved public resistance.

By building fusion reactors based on deuterium and tritium and trying to protect them with redundant backup systems, he was convinced, American engineers had bet billions of dollars on the wrong horse. And Lidsky argued further that while research into "fail-safe" neutron-free fusion and HTGR (high temperature, gas-cooled reactor) fission offered promising alternatives, they were no panacea.

The article, "The Trouble with Fusion," generated its own fallout. It was reprinted in the *Washington Post* and other newspapers, translated into nine languages, and became the centerpiece of a debate about reactor design in China. Lidsky was asked to resign, to put it politely, from the Plasma Fusion Center, where he

had been associate director.

"It was not the party line," he recalled recently. "I was putting at risk the direction of the second biggest lab at MIT—a lab with an annual budget of \$30 million."

"If it's done correctly, nuclear power can be important. On the other hand, it's become clear that if it depends on human beings behaving 'excellently' at all times, it will fail."

"We see the results of acid rain. Environmentalism

is the only reason to do work on nuclear power. You don't do it so man can control the atom and rule the animals and have domain over the earth. One of my recent concerns is the design of the direct-cycle, modular, gas-cooled [fission] reactor. I want to see if I can produce a nuclear reactor that is non-polluting, cannot release radiation to the public no matter what mechanical error or malicious operator is involved, and is cheap—one that will be preferable to any other energy source."

Lidsky's rejection of current fuel choices and nuclear industry economies of scale have made his work unpopular with his colleagues. But he isn't exactly loved by environmental activists, either. They point out that the European-style reactors he favors, which are one-fifteenth the size of conventional American installations, still produce radioactive waste.

Yet his position does have some

powerful supporters, including Paul Gray, '54, chairman of the Corporation. "I'm one of those who believes that as the industrialized and industrializing nations of the world deal with the issues associated with energy supply and security—especially related to environmental degradation and the greenhouse phenomenon—we will have to come to terms with nuclear fission," Gray says. "Fusion has some promise, but we cannot be confident of its economic projections or timeliness. Fission is a technical capacity that we now possess, and it will become an energy source to which we will have to return. When we do so, it has to be from a different technical perspective."

"There are important differences between the concepts Larry is interested in and Seabrook or Pilgrim [nuclear power plants] in terms of scale and cost, mass production potential, operating stability, and health hazards," Gray notes. "The concepts he's talking about are not incremental improvements but discontinuous changes from what we see today."

Growing up as a kid who liked to spend time working with his hands, Lidsky says that the engineering physics program he took as a Cornell undergraduate inhabited a "half-world" between science and engineering. He has written that in these two fields, a problem may be defined similarly—but "scientists and engineers often have different perspectives as to what constitutes a 'good answer.'"

"I can solve an engineering problem in isolation," he says. "But a problem solved in the full complexity of the world is harder. Reductionism will take you just so far. After 200 years of taking reductionism to the limit, we're beginning to be smart enough to handle complexity. . . the interconnected order under apparent chaos."

Lidsky's commitment to finding more holistic research approaches

*When students
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they don't know
how complicated
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attention
to that.*

was evident in his earliest graduate student days. He has one vivid memory of being taken to a meeting in Schenectady with his MIT mentor and thesis advisor, the late Professor David Rose, PhD '50. "I looked around at the best and the brightest in plasma physics and said 'Is this all there is?' They were so narrowly focused!"

Today's MIT students will be shaken from such constraints if Lidsky has anything to say about it. He is co-director—with historian of science Merrit Roe Smith—of the Institute's Contexts Initiative, a program that encourages undergraduates to focus on the social, cultural, environmental, economic, and ethical contexts in which new scientific knowledge and technological applications are pursued.

This year, for example, the program sponsored symposia on cancer drugs, national productivity, and software copyright. "Where we'd like to be is having an impact on how students and faculty think about their careers and career objectives beyond their technical expertise as engineers and scientists," Smith explains. "We'd love to encourage interaction among people from different disciplines. Larry's own greatest ability is to cross in-

tellectual boundaries. The context program is one contribution to the reformulation of how MIT trains scientists and engineers."

And to those who claim that this emphasis on the social or political implications of scientific decision making is "technology bashing," Lidsky has a puckish reply: "There is some technology that needs to be bashed."

Ralph Moir, ScD '67, was Lidsky's second graduate student; he has spent the last 23 years in magnetic fusion research at Lawrence Livermore Laboratory. "I think Lidsky learned to ask hard questions from David Rose," Moir says. "Rose was fabulous in the way he could penetrate to the key questions with humor. But Lidsky takes the gloves off, to expose the questions directly. It's a frontal challenge—his agenda is not hidden. And if you stand up in front of the audience to make a critique and listen to their response, as he does, you get respect."

There is nothing accidental about Lidsky's relationship to his students. "When students come to MIT, they don't know how complicated the world is—you have to bring that to their attention. But you don't have to worry about their idealism, their motivation, or their integrity."

"It used to be that a research environment was a given, and you tried to optimize that. No one thought to question the rules that said, 'here is so much money, and it is for this purpose.' My job as a teacher is to make a protected environment, free from the pressures early on that would cause students to lose faith in their own personal vision. Later, they'll be strong enough to know that just because some authority figure says something, it ain't necessarily so." □

DEBRA CASH is a regular contributor to SPOTLIGHT.



COURSE NEWS

I CIVIL ENGINEERING

Major General **Robert F. Seedlock**, SM '40, reports that he is a "member of the Voice of America's Radio Engineering Advisory Committee; U.S. representative to Permanent Technical Committee #1 (Inland Waterways) of the Permanent International Association of Navigation Congresses; editor of the *ASCE Journal of Aerospace Engineering*; president of the American chapter of the Burma Star Association; and is a consulting engineer in his spare time!" . . . **William O. Mad-daus**, CE '69, sends word from Alamo, Calif.: "I joined James M. Montgomery Consulting Engineers in October 1990. I am a principal engineer in the Water Resources Department specializing in water conservation and water resources investigations. My oldest daughter, Lisa, just started the engineering program at U.C. Davis." . . . From Chiba, Japan, **Yoshihiro Ichikawa**, SM '68, writes: "I am now director of the Planning Department for Japan Highway Public Corp. It was a pleasure to have Professor Richard de Neufville visit our corporation last December while he was staying in Tokyo as a leadership fellow of the U.S.-Japan Leadership Program."

Doug Merkle, PhD '71, writes: "I am an associate, principal engineer, and head of the Air Base Structures and Weapon Effects Group of Applied Research Associates' (ARA's) Gulf Coast Division at Tyndall AFB in Florida, near Panama City. I am also active in ASCE, NSPE, and SAME, and am chair of the Lake Sands District Committee of the Boy Scouts of America."

Robert S. Broughton, SM '59, sends word from Ste. Anne De Bellevue, Quebec: "I was appointed director of the Centre for Drainage Studies at McGill University in May 1987. My group is putting on an international drainage course from May 6 to June 7, 1991. This course is a great help to people working on reclamation of saline irrigated lands. Engineers come from the U.S., Canada, Egypt, Pakistan, India, China, Trinidad, Kenya, Malawi, and other countries. My colleagues and I have taught graduate-level courses on land reclamation in Egypt and Pakistan. I was granted an honorary LLD by Dalhousie University in May 1989."

Elliot Steinberg, SM '80, is a senior engineer with Haley & Aldrich, Inc., and was elected director of the Boston Society of Civil Engineers for 1990-91.

Matthew D. Reynolds, SM '85, has become a consultant for John D. Tewhey Associates, Inc., in South Portland, Maine. He was formerly a senior geohydrologist at ABB Environmental Service in Portland.

Kenneth M. Childs, Jr., '52, was recently elected president of the Boston Society of Civil Engineers, a section of the American Society of Civil Engineers. He is the founder and president of Childs Engineering Corp. in Medfield, Mass. . . . **Allen H. Wahlberg**, '55, has been elected senior VP of the Turner Corp. in New York, N.Y. He will continue to serve as CFO of the corporation with executive management responsibility for the treasury and accounting functions, pension fund investment, and internal audit.

Erwin W. Liang, SM '85, has joined the General Electric R&D Center as a mechanical engineer. Liang earned a PhD in theoretical and applied mechanics in 1990 from the University of Illinois. . . . **C.L. Miller**, '51, former head of Course I, has written *The COGO Book: Fundamentals, Con-*

ventions, and Standards of Coordinate Geometry for Civil Engineers and Surveyors (CLM Systems, Inc., 1990). Miller is credited with creating COGO software beginning in 1959-60 while at MIT. According to a CLM press release, "the book is not a COGO manual nor a math or surveying text book. It is primarily concerned with concepts and conventions in graphical (picture book) form."

The Alumni/ae Association has been notified of the following deaths: **Verne N. Osmundson**, SM '39, of Greensburg, Kans., in November 1989; **Roy W. Carlson**, ScD '39, of Oakland, Calif., on November 21, 1990; Colonel **Craig Smyser**, SM '39, of Houston, Tex., on June 12, 1988; and **Raul J. Marsal**, SM '44, of Mexico City, Mexico, on December 2, 1990. There was no further information provided.

II MECHANICAL ENGINEERING

M.T. Benchaita, PhD '80, writes: "I was recently promoted to manager of product performance at Pennzoil Products Co. in The Woodlands, Tex. Additionally, I am the company liaison for European engine manufacturers, i.e., Mercedes-Benz, Porsche, Fiat, Peugeot, etc." . . . **Anthony C. Lunn**, ScD '72, sends word: "I had been working on medical device R&D at Johnson & Johnson for nine years. I have now moved to J&J Interventional Systems as program manager for advanced technology. I will be working on cardiovascular stents for use in balloon angioplasty. My wife, Phyllis, and I continue to live happily in Princeton, N.J." . . . **Michel L. Morin**, SM '68, writes that he is president of Machine Vision and is currently trying to sell another company, Cencit, Inc., a St. Louis, Mo.-based manufacturer of 3-D optical scanners. . . . **Dwight E. Beach, Jr.**, SM '65, reports: "I am still president of Houston Engineers, Inc., as I have been for the past nine years. The company is a leading supplier of impact drilling jars and accelerators for worldwide drilling industry. We have recently introduced advances in these tools as well as underreamers to the oil industry."

Charles R. Faulders, ScD '54, sends word "I retired after 36 years with Rockwell International and I'm now catching up on house and yard projects" . . . From Burr Ridge, Ill., **James E. Korenchan**, SM '84, writes: "In June 1990 I was promoted to the position of supervisor of engine structural development at the Electro-Motive Division of General Motors. Last July, my wife, Beth, gave birth to our second son, David, 15 months after the birth of our first, Jimmy." . . . **Pamela Adams**, '84, is one of four editors that contribut-



E.W. Liang

ed to *Advanced Materials: Looking Ahead to the 21st Century* (Society for the Advancement of Material and Process Engineering, 1990). The book, which is volume 22, covers the 22nd International SAMPE Technical Conference, held in Boston, last November.

Mamerto E. Cruz, SM '41, of Deptford, N.J., died on December 11, 1990. His major fields of study were physical organic chemistry and polymers. Cruz was associated with American Viscose Corp., Olin Mathieson Corp., FMC Corp., and operated his own consulting company called Morca, Inc. He was an expert in rayon and cellulose acetate fiber technology, supervised pilot plant production of cellophane, developed new wet strength additives for paper and worked out some of the concepts and process technology of the macro-molecular colloidal forms of polypropylene, nylons and polyesters. Cruz wrote two technical books and was granted over 100 U.S. and foreign patents, five of which were granted after his retirement.

Chung-Hua Wu, ScD '47, has been elected a Fellow of the ASME. Now a retired director of the Institute of Engineering Thermophysics at the Chinese Academy of Sciences in Beijing, Wu is known throughout the world for laying the foundation for the aerodynamic theory used in the design of turbomachinery from the 1950s to the present. He is also noted within China for his leadership of and contributions to R&D in thermodynamic and combustion processes leading to major advances in the efficiency of heat power systems.

Sun-Jae Kim, a Course II graduate student, died on the morning of November 21, 1990, while driving to New York City to meet his mother. He was 23 years old. Kim was apparently killed instantly after his car hit a railing and flipped over several times. His brother, who was driving the car, was not hurt, most likely because of an air-bag in the steering wheel. **Dae Eun Kim**, G, who shared an office with Sun-Jae Kim, called his friend's death a "tragedy for everybody here," and described him as "a very outgoing guy, a friendly guy. He had a very bright future." He added that Kim "used to crack a lot of jokes," and enjoyed playing tennis. A graduate of Seoul National University, Sun-Jae Kim was studying with Professor Nam Pyo Suh, '59. Kim's father is the CEO of the Daweoo Corp., a major electronics manufacturer in Korea.

III MATERIALS SCIENCE AND ENGINEERING

Kenneth B. Larson, PhD '64, writes: "I am a faculty member of the Washington University School of Medicine with rank of research professor. My research work involves applications of mathematics and computers in biology and medicine. At present I am working with neurologists mapping human-brain function in vivo using positron emission tomography." . . . The International Metallographic Society's Pierre Jacquet Gold Medal and the Lucas Award of ASM International, the grand prizes in an international metallography competition, have been awarded to **John Vitek**, '68, of the Metals and Ceramics Division at Oak Ridge National Lab (ORNL) and two of his colleagues. This is the third time in the past four years the team has won this prestigious award, a feat never achieved by anyone else in

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the history of the competition. The two awards recognize a technical poster entered in the competition's electron microscopy category entitled "Controlled Residual Elements Improve Creep Properties of Stainless Steel Welds." A member of the microscopy and microanalytical group, Vitek joined ORNL in 1980 after working with the Metals Research Lab of the Olin Corp.

Course III Professor **August F. Witt**, internationally noted for his research in electronic materials, has been named to hold the TDK Professorship in Materials Science & Engineering at MIT. Witt has worked on magnetic stabilization of metallic melts and pioneered its application to semiconductor growth on an industrial scale. In collaboration with Professor **Harry C. Gatros**, PhD '50 (V), Witt has been involved in space research since the beginning of the NASA program. He has been concerned with the exploration of the potential of reduced gravity environment of outer space for R&D in electronic materials processing. The thrust of this effort is now directed at the development of telepresence concepts aimed at the optimization of the ground-based control and analysis of experiments conducted in space. Last year, the MIT School of Engineering named Witt the first recipient of the Amar Bose Award for Sustained Efforts in Undergraduate Teaching.

IV ARCHITECTURE

William W. Ahern, MAR '51, sends word from Belmont, Mass.: "A design proposal for a new microwave landing system for the nation's airports has brought together five members of the class of 1951 in a Raytheon and Electronic Space Systems team effort. The other class members are Dick F. Chiacchia, '51 (XIV), Al Cohen, '51 (VI), Joe Sangiolo, '51 (II), and Dick D'Amato, '50 (XVI). The problem: design structures that will withstand 150 mph winds from jet engines 500 times per month, but that will break up under impact of a light plane!" . . . **John S. Reynolds**, MAR '67, reports: "After my return to Oregon from a Fulbright grant to Argentina, I completed my half of writing the 8th edition of *Mechanical and Electrical Equipment for Buildings* to be published in 1991 by John Wiley & Sons." . . . **Ming H. Wang**, PhD '87, writes: "I've been teaching in the Department of Architecture at National Cheng-Kung University in Tainan, Taiwan, since 1987 as an associate professor. I recently received an honor from the university for supervising a graduate student whose thesis design won the first prize of the 1990 Royal Institute of British Architects International Student Competition."

Florian von Buttlar, MAA '74, sends word from Berlin of his recent accomplishments: "Publication of the book *Lenne im Hinterhof* (with Stefanie Endlich) (Transit Verlag, Berlin, 1989); conception and realization of the exhibit 'Peter Joseph Lenne-Volkspark und Arkadien' during June and July of 1989 in Berlin; publication of the exhibition catalogue of the above, same title (Nicolai-Verlag, Berlin, 1989); supervision of urban design competition 'TBA-Emscher Park' in Bottrop, Germany, in 1990; research project for the German Historic Museum in 1990 also." . . . **Manfredi G. Nicoletti**, MAR '55, is one of two Romans chosen to design the new Acropolis Museum in Athens. Nicoletti will collaborate with Lucio Passarelli on the structure, to be built at the foot of the Acropolis for an estimated \$100 million. Nicoletti, a professor of architecture in Rome, said the entrance and part of the museum will be below ground, to convey the idea of a "descent into history." On a higher note, he prepared the design for a bridge over the strait of Messina that will join Sicily to the mainland.

Shawn Brixey, SM '90, is currently pursuing a one-year visiting professorship in the University of Kentucky Art Department, teaching video and performance art. In his craft, Brixey uses highly sophisticated and technological equipment to create an "art apparatus," which then uses light,

sound, and other forces to interact with humans. Brixey shared an exhibit with Yoko Ono at the Cranbrook Academy of Art Museum in Detroit, which ran from October through December 1989. Ono's exhibit was titled "The Bronze Age" and Brixey's was "Celestial Vaultings." The show was intended to portray the beginning of avant-garde art through Ono and the future through Brixey. At this writing he was scheduled to have a show in April at the Contemporary Arts Center in Cincinnati. . . . **Todd Siler**, PhD '86, has written *Breaking the Mind Barrier: The Artscience of Neurocosmology* (Simon and Schuster, 1990). According to the dustcover, "using primarily his own artworks, which have earned him international acclaim, Siler shows how the brain is what the brain creates; how all models of the world model some aspect of the brain's world of processes; how its workings reflect the workings of its creations, whether machines or art or ideas." Siler is a research affiliate at the Computer-Aided Design Lab in the Department of Mechanical Engineering at MIT. He has been exhibiting his work internationally in major museums and galleries for the past ten years.

Tridib Banerjee, PhD '71 (XI), and **Michael Southworth**, PhD '70 (XI), have edited *City Sense and City Design: Writings and Projects of Kevin Lynch* (MIT Press, 1990). **Lynch**, BCP '47, who died in 1984, studied with Frank Lloyd Wright at Taliesin and later obtained his degree from MIT. After a long and distinguished career in MIT's School of Architecture and Urban Planning, he was named professor emeritus of city planning. "Lynch's books are the classic underpinnings of modern urban planning and design, yet they are only a part of his rich legacy of ideas about human purposes and values in built form. [The book] brings together Lynch's remaining work, including professional design and planning projects that show how he translated many of his ideas and theories into practice," states the book jacket.

Ruth M. Perkins, of Wayland, Mass., died on January 19, 1991. Perkins completed two years of a three-year program and was one of the first women in MIT's Architectural Engineering program. She went on to earn a masters in the teaching of reading at the University of Maine at Orono and a doctorate in mathematics education at the University of Michigan. She was supervisor of remedial reading in Hudson, N.H., Oak Bluffs and Andover, Mass. In 1961 she became a Vermont State Helping Teacher, supervising the Northeast District. She spent the remainder of her career training mathematics teachers, first at UConn and finally at Temple University. She co-wrote the revised edition of *Mathematics of Finance* by Perkins and Perkins, and *Jed Strong* by St. John and Perkins, as well as articles in math education.

V CHEMISTRY

Mankil Jung, SM '78, assistant professor of medicinal chemistry at the University of Mississippi, writes: "I gave an invited lecture at the University of Oxford in England. The title was 'Stereospecific Synthesis and Antimalarial Activity of Artemisinin-Related Compounds.' I also presented a paper at the International Joint Symposium on Biology and Chemistry of Active Natural Substances in Bonn, Germany." . . .

Robert R. Luise, PhD '70, sends word from Boothwyn, Pa.: "I gave a seminar at MIT last September entitled 'High Strength Materials from Liquid Crystalline Polyesters,' by invitation of the polymer science and technology division. I am a research associate at DuPont's Experimental Station in Polymers." . . . **Crist Scott Blackwell**, PhD '71, and **Kathryn Lynn Parker** were married in Little Rock, Ark., on October 27, 1990. The couple will reside in Pleasantville, N.Y. . . . **Donald M. Smyth**, PhD '54, sends word from Bethlehem, Pa.: "I received Lehigh University's Libsch Research Award for 1990 (with M.P. Harmer). I

also received the Kraner Award from the Lehigh Valley Section of the American Ceramic Society."

Alan E. Walts, PhD '85, writes: "I was recently promoted to VP for chemical and biopolymer research at Genzyme Corp. located in Cambridge. My responsibilities include managing research efforts in chemistry and biomaterial development, and managing a program focused on the use of biomaterials for post-surgery adhesion prevention. I have been at Genzyme since July 1986."

Judith Herzfeld, PhD '72, a professor of biophysical chemistry at Brandeis University since 1985, has been promoted from associate to full professor. Herzfeld is a theoretical and experimental chemist whose research includes polymers and solid-state nuclear magnetic resonance. Her research on macromolecules is of interest to biologists and biophysicists studying the properties of sickle-cell hemoglobin. The National Institutes of Health have invited her to membership on several study sections, and the American Physical Society and the Biophysical Society have both elected her to office. . . . **Ajay K. Bose**, ScD '50, the George Meade Bond Professor of Chemistry at Stevens Institute of Technology in Hoboken, N.J., has been selected 1990 New Jersey Professor of the Year by the Council for Advancement and Support of Education, together with the Carnegie Foundation for the Advancement of Teaching. Bose founded Chemical Biology Education Enhancement at Stevens, a program that in 1989 was awarded a \$1 million grant by the Howard Hughes Medical Institute.

Commander **Samuel F. Allison**, '33 (ret.), of Walnut Creek, Calif., died on November 11, 1990. His education included Susquehanna University, MIT, and The George Washington University, where he studied law. He was a commander in the Navy, serving in the Bureau of Aeronautics, and subsequently practiced patent law. . . . **Richard C. Lord**, emeritus professor of chemistry at MIT, died on April 29, 1989, after a long battle with Parkinsonism. He received a PhD from Johns Hopkins in 1936, taught there until 1942, and then spent the war years at MIT as a technical aide and deputy chief for the National Defense Research Committee program on optics. For this service he was awarded the Certificate of Merit by President Truman in 1948. In 1946 Lord became director of MIT's Spectroscopy Lab and became professor of chemistry in 1954. Until his retirement in 1976, he trained over 2,000 industrial and academic researchers in the intricacies of infrared spectroscopy. He was the author of over 150 technical articles and books. Lord also served as a visiting professor at Notre Dame (1958), University of California at San Diego (1960), and University of Georgia (1971).



A.K. Bose

VI ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

Fred J. Leonberger, PhD '75, of Glastonbury, Conn. was awarded the 1990 George Mead Award by United Technologies Corp., (his employer's highest technical award) for development of annealed proton exchange method of forming integrated optical circuits. . . . **George W. Lecompte**, SM '55, reports that he retired from Hughes Aircraft Co., in Tucson, Ariz., in Decem-

ber 1989. . . . **David D. Holmes**, SM '50, writes that he received a Distinguished Engineering and Science Award from the University of Maine in 1987. . . . **Craig A. Armiento**, PhD '83, reports: "Currently a research supervisor at GTE Labs in Waltham, Mass., working in the area of optoelectronic component integration. I reside in Acton, Mass., with my wife, Barbara, and two children, Bryan and Kaitlyn." . . . **Al Gasiewski**, PhD '89, sends word from Atlanta, Ga.: "I'm involved in research on satellite-based Earth remote sensing techniques for weather observation. This work is carried on within the School of Electrical Engineering at Georgia Tech."

From Groomsport, Ulster, Northern Ireland, **Robert W. Adams**, SM '32, writes: "Being well past the '80 milestone, I am mostly a 'has been.' I have been a lifelong dinghy sailor but that is at present in abeyance as I am building a new 16-foot boat. I support a political party of which the main objective is to keep Ulster British! I support 'conservation' of the environment and am particularly concerned to promote limitation of world population. Music of the classical kind is a main interest as I have been a church organist, but an end has been put to that by arthritis!" . . .

Peter J. Denning, PhD '68, reports from Portola Valley, Calif.: "In 1989-90 I received two awards. One was the distinguished service award of the Association for Computing Machinery, and the other was a distinguished service award from the Computing Research Association. After serving as

1898-1991

Edward L. Bowles Radar Pioneer



Edward L. Bowles, SM '22, an electrical engineer who helped to develop radar during World War II, died on September 5, 1990. He was 92 and lived in Wellesley, Mass.

Bowles began teaching at MIT in 1921 and was named a full professor in 1937. In 1942 he left MIT to become a consultant to Secretary of War Henry Stimson.

A microwave specialist, Bowles was asked to devise countermeasures to the German submarines that were sinking freighters in the North Atlantic. He set up a lab at Langley Field in Virginia, where Army Air Corps bombers were equipped with radar developed by Bowles and others at MIT. He also outfitted planes with rocket flares, electrical altimeters, sonobuoys, homing devices, magnetic detectors, and other devices to detect U-boats at great depths. He was asked to expedite the dispatch of materials to help the British defend against Ger-

man buzz bombs in the summer of 1944, and he later wrote that 90 percent of the buzz bombs were destroyed.

Bowles' many honors included the Distinguished Service Medal by special order of President Truman, the Presidential Medal of Merit, and the Order of the British Empire. An expert in the field of radio, Bowles also pioneered the the de-

velopment of the multivibrator, by which a tuning fork, and later a crystal, could be used to maintain a precise radio frequency. He established a division of electrical communication at MIT in the mid-1920s.

After the war, Bowles served as a consultant to the president of Raytheon Co. In 1955 he headed a congressional advisory committee that suggested ways of allocating UHF television channels. He continued his professional consulting and his association with MIT, becoming professor emeritus of MIT's Sloan School of Industrial Management in 1963. □

director of the Research Institute for Advanced Computer Science (RIACS) at the NASA Ames Research Center since 1973, last August I stepped aside into a research fellow position within RIACS." . . . **Arlyn W. Boekelheide**, SM '52, writes: "Thanks for sending the RLE Currents. Hope to attend my 40th class reunion in 1992."

Richard L. Freudberg, SM '57, reports from Auburndale, Mass.: "I am an EE consultant of digital signal processing and algorithm evaluation and development via computer simulation. One of the places I consult for is the Voice Engineering Department at Wang Labs in Lowell, Mass. I develop and test algorithms on the computer using input data from the real world or from artificial sources." . . . **Jim Van Etten**, EE '50, sends us a letter from Nutley, N.J. He says he still continues to derive much pleasure from reading every issue of *Technology Review*, and he tells us to "keep up the good work." He reports: "I have been elected a Fellow of the Institute of Electrical and Electronics Engineers, effective January 1, 1991, with a citation for 'contributions to the development of the loran radio navigation system.' I graduated from the U.S. Coast Guard Academy in 1943, went to MIT, and served in the USCG from 1943 to 1958. I was employed by IIT Avionics from 1958 until my retirement in 1984. During that time, I held various executive engineering and marketing positions. Since my retirement, I have been a consultant in engineering, marketing, and navigation."

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Peter G. Pantazelos, SM '55, is the new president of the Alpha Omega Council. He continues as executive VP and director of corporate development at Thermo Electron Corp. in Waltham, Mass. . . . **Phyllis A. Koton**, '79, has been promoted to principal scientist in Mitre's Information Systems Division. In her new position, Koton will oversee the division's artificial intelligence work and will continue to coordinate other AI programs within the corporation as part of her AI Integration Team duties. In addition she will continue to conduct her own research within the program.

Louis S. Metzger, '69, has been promoted to technical director in Mitre's Strategic Communication Division. Metzger's areas of expertise include communications, detection, and estimation theory. He has experience in satellite communications, with particular emphasis on systems involving spread-spectrum techniques, low-probability-of-intercept features and on-board satellite signal processing.

Cha-Mei Tang, '71, head of the Radiation and Acceleration Physics Section, Beam Physics Branch in the Naval Research Lab's Plasma Physics Division, has been elected a Fellow of the American Physical Society. Tang was cited for "her pioneering work in the development of computer models and codes for understanding the physics of free electron lasers, quasioptical gyrotrons, and laser plasma accelerators." Tang assumed her present position at NRL in 1985. . . . *Intelligent Embedded Systems* (Addison-Wesley, 1991) is a new book by **Louis L. Odette**, PhD '81. The book illustrates new programming techniques for incorporating intelligent systems technology into programs. It is for engineers and programmers who design, prototype, or code embedded microprocessor-based systems. Odette is responsible for new business development at Applied Expert Systems, Inc. (APEX), in Cambridge.

James R. Melcher, PhD '62, of Lexington, Mass., died of cancer on January 5, 1991. Melcher, a member of MIT's Course VI faculty since 1962, was director of the Lab for Electromagnetic and Electronic Systems. He was noted for work that defined the field of continuum electromechanics and for leading in its application to human needs in areas such as air-pollution control, energy conversion, plasma physics, measurement of fluid flows, control of the thickness of sheet glass, generation of electricity via the flow of fluids in electric and magnetic fields, electric power apparatus, and physiology. Considered an outstanding educator—he received the Outstanding Teacher Award from the New England Section of the American Society for Engineering Education in 1969 and the MIT Graduate Student Teaching Award in 1978—Melcher was noted for his dynamic lectures, particularly in electromagnetic field theory. He wrote six books, among them a graduate text published in 1981, *Continuum Electromechanics*, which remains the definitive text in the field. He was a member of the NAE, a Fellow of the IEEE, and a member of the APS, ACS, and ASME. Among his last efforts was an article published in the April 1991 *Tecnology Review* (page MIT 4).

The Alumni/ae Association has been notified of the following deaths: **Rafael Cintron**, SM '70, of San Juan, Puerto Rico, in 1989, and **Natalio Kerlennovich**, EE '65, of Lexington, Mass., on March 5, 1986. There was no additional information provided.

VI-A INTERNSHIP PROGRAM

For this writing, being done the middle of February, there's both good news and sad news to report. The sad news is that the Department lost a very capable young faculty member, Professor **James R. Melcher**, PhD '62, who died on January 5, about six months after being diagnosed with cancer. Cited by the American Society for Engineering Education and the MIT Graduate Student Association for his outstanding teaching, he was director of our Laboratory for Electromagnet-

ic and Electronic Systems (LEES). He was elected a Fellow of the IEEE. I had known Jim since I first came to MIT, in February 1956, when he was a graduate student here. We'll all miss him greatly.

A copy of a letter from the British Embassy in Washington brings notice of the coming elevation of **Cecil H. Green**, '23, to "Honorary Knight of the Most Excellent Order of the British Empire" (O.B.E.), ceremonial date to be announced. Cecil was born in England and has continued a long philanthropic involvement with Oxford University, which bestowed on him an honorary doctorate in 1988. Many of you who VI-Ad at Texas Instruments, Inc., will have fond memories, as Director O'Toole and I do, of the annual VI-A summer luncheons Cecil hosts at the Petroleum Club in Dallas. Many hip-hip-hoorays for VI-A'r Cecil H. Green!

Another VI-A'r, and member of the Department's faculty, deserving congratulations is **James L. Kirtley, Jr.**, PhD '71. Jim has just been elected a Fellow of the Institute of Electrical & Electronics Engineers (IEEE). . . . One of our current VI-A students, **Daniel Tunkelang**, '92, is among those selected as 1991 Burchard Scholars. This program brings together distinguished members of the faculty and promising juniors and sophomores who have demonstrated excellence in some aspect of the humanities and social sciences as well as in science and engineering. They gather at dinner-seminars throughout the year to discuss various topics of current research of special interest to the participants.

The annual orientation and selection process for a new VI-A class began on February 6 with Director O'Toole's opening orientation lecture. About 190 students gathered in Edgerton Hall (34-101) for the hour-long talk on how the program operates and the process for getting selected. One week later, the popular student-run VI-A Open House played host to over 200 attendees, one of our largest groups ever. At this open house students currently in the program represent their employing companies by providing one-on-one information to potential applicants, thus helping these students narrow their choices of which company representatives to interview with the first week in March.

The current sophomore class in Course VI (325) is 22% larger than a year ago, hence the larger attendance at these first two functions. Unfortunately, according to O'Toole, the number of openings in the new VI-A class will be down slightly from a year ago, or about 80-85. Some companies may take fewer students, and some, like Analog Devices, Inc., GE's R&D Center in Schenectady, N.Y., and GenRad, will not be taking any new students this year. Fewer openings for a larger class will make for greater competition among those applying in 1991.

We've had special contacts from a number of alumni/ae, since our last article and I'll mention them in alphabetical order. A fax, as I write, from **Bain & Company, Inc.**, tells us that **Vernon E. Altman**, SM '73, VP of the San Francisco office, has been named to the firm's board of directors. . . . **Jeffrey P. Applebaum**, SM '90, was east from Sunnyvale, Calif., and paid us a visit. . . . **Steven L. Bates**, EE '76, called to tell me of his new position in Westford, Mass., with Tau-Tron, Inc., manufacturers of telecommunications test equipment. . . . **Edmond Chalom**, SM '89, stopped to tell us he has returned to MIT to pursue doctoral studies.

I met **Anthony P. DiPesa, Jr.**, SM '87, in Bldg. E19 where he's now working in the MIT Facilities Management Office following a period with Oracle in California. . . . I had a pleasant conversation with **Michael A. Fetterman**, who has completed his thesis and will receive his Master's degree this month. Mike is currently working with Intel Corp. in Beaverton, Ore. . . . I had a meeting with **K. Alexander McDonald**, '81, who's on campus for a short time working with Lee D. Weinstein on the solar car project. Following VI-A at TI, Alex went with H-P in Houston and then

Chrysler in Detroit before getting an MBA, after which he consulted for several start-up companies.

A belated Christmas letter from **Louis A. Nagode**, SM '81, relates his family activities, which included a visit east, earlier, as a guest of yours truly. . . . We learned that **Philip J. Robinson**, SM '62, has recently transferred from Tektronix to be a VP at Mentor Graphics in Beaverton, Ore., where **Geoffrey J. Bunza**, PhD '81, is general manager of R&D. . . . And lastly, I ran across **John V. Wolfe**, SM '88, while shopping at the Tech Coop in Kendall Square. He is working in the Cambridge area doing systems work, having done some for KLM, which took him to Holland a number of times.

Again, a reminder that 1992 finds the VI-A Program in its 75th year of operation (started in 1917 with MIT EE Class of '19) and we'd like feedback on what to do for a gala celebration. Course X-A is celebrating its 75th this year and I'm following their activities with interest.—**John A. Tucker**, VI-A Director (Emeritus) & Lecturer, MIT, Rm 38-473, Cambridge, MA 02139-4307.

VII BIOLOGY

Phillip A. Sharp, director of the Center for Cancer Research, will become head of the Department of Biology, effective July 1, and Professor **Richard O. Hynes**, PhD '71, who now heads the department, will become director of the center on the same date. Sharp, internationally respected as a molecular biologist, is the John D. MacArthur Professor of Biology. He has headed the center since 1985 and was associate director from 1983 to 1985. He has been a member of the center since 1974 and will continue to be a member. He is well known for his research on gene regulation and for the discovery of the phenomenon of RNA splicing. Hynes, a distinguished cell biologist whose research focuses on the molecular basis of cell structure and adhesion, has headed the department since July 1989 and was associate head from 1985 to 1989. His cellular and molecular biological studies have focused on a family of adhesive glycoproteins, fibronectins, which permit cell adhesion and migration, as well as on a family of cell surface receptors, integrins, which mediate the attachment of cells to fibronectins and other analogous proteins. The attachments of cells to solid surfaces and to each other play vital roles in cell behavior during embryological development and in important physiological processes such as hemostasis, thrombosis, wound healing, and cancer.

Cindy Lee Van Dover, PhD '89, is the first female to pilot *Alvin*, a three-passenger deep-diving research submarine. For 26 years the submarine has been making dives, but it wasn't until December 1990 that *Alvin* recorded its first all-female crew. Elana Leithold and Cynthia Huggett, both of North Carolina State University, and Van Dover, made a three-week expedition on the Fieberling Guyot, an underwater mountain about 500 miles off the coast of San Diego. The divers studied the effects of ocean eddies on the biological communities of the guyot, or flat-topped mountain. Because of the difficult terrain of the guyot, the animals were virtually impossible to sample by lowering nets and other gear from the ocean surface. *Alvin* has permitted scientists to see into the deep ocean and to study the variety of plants and animals living there. *Alvin* and its support ship, the *Atlantis II*, will spend 1991 in the eastern Pacific working between Acapulco, Mexico, and Seattle.

Donald Rio, Course VII assistant professor, has been selected to hold the Robert A. Swanson '70 Professorship in Life Sciences at MIT. Rio, whose work has included gene expression mechanisms and nucleic acid-protein interactions, is also on staff at the Whitehead Institute for Biomedical Research, an MIT affiliate. He has received both a

Presidential Young Investigator Award from the NSF and the Markey Scholar Award. The Swanson Professorship, established in 1986 by the co-founder and CEO of Genentech, recognizes junior faculty who make important career strides in the field of life sciences.

Edward P. Hutchinson, PhD '33, of Wayne, Pa., died on December 16, 1990. Hutchinson was professor emeritus of the University of Pennsylvania. He taught at the university from 1943 until his retirement in 1976. A demographer, his research focused on immigration and U.S. immigration legislation. He was a trustee emeritus of the Balch Institute of Ethnic Studies, an organization he helped found in 1971, and was the author of several publications. He received an honorary degree from Bowdoin College in Brunswick, Me., in 1982 and spent sabbaticals at the London School of Economics, the University of Canberra in Australia, and in Stockholm, Sweden.

VIII PHYSICS

Norman C. Rasmussen, PhD '56, the McAfee Professor of Engineering in nuclear engineering, has received the 1990 Distinguished Contribution Award of the Society for Risk Analysis. He was honored for his long concern with risk assessment in the nuclear energy field dating back to the "Rasmussen report," formally titled "Reactor Safety Study: An Assessment of Accident Risks in U.S. Commercial Nuclear Power Plants," in 1975. . . . **Victor F. Weisskopf**, Institute Professor Emeritus, has been named the recipient of the 1991 Forum Award. The award was presented at the spring meeting of the American Physical Society (APS) in April. The citation reads, "For his life-long effort to stimulate public awareness of the beauty of science and the dangers of its abuses." . . . **Daniel Kleppner**, the Lester Wolfe Professor of Physics at MIT, has been named the recipient of the 1991 Julius E. Lilienfeld Prize, given by the APS. His citation reads, "For his contributions to the development of the atomic hydrogen maser and other techniques for precise spectroscopy of neutral atoms, and for the clarity of his expositions of the physics involved."

Two other Course VIII professors have been honored by the APS. **Patrick A. Lee**, PhD '70, has been named the recipient of the 1991 Oliver E. Buckley Condensed Matter Physics Prize for "his innovative contributions to the theory of electronic properties of solids, especially of strongly interacting and disordered materials." **David E. Pritchard** has been named the recipient of the 1991 Herbert P. Broida Prize for "outstanding contributions to atomic, molecular, and optical physics, including his monumental studies of energy transfer in molecular collisions; seminal research on atom wave interferometry and atom optics, numerous studies of the forces of light on atoms and their application to atom cooling and trapping, and his development of single ion mass spectroscopy."

X CHEMICAL ENGINEERING

Peter Glenshaw, SM '59, sends word from Washington, D.C.: "Working at the World Bank on industrial development in Eastern Europe and Africa—particularly chemicals, fertilizers, and petroleum. Unbelievably complex and frustrating trying to transform devastated political and economic situations, but at the working level the people are so willing and eager to succeed that we must keep trying." . . . **Clarence Hanford**, SM '53, reports from Aurora, Ore.: "Two years ago I sold my company, Horizon Technologies, to La Porte of the United Kingdom and stayed on as executive VP of Vinings West, one of their subsidiaries. I will probably work for one more year and then retire." . . . From Waterloo, Ontario,

James F. McKay, SM '49, writes: "Last fall I conducted a three-day workshop on statistical pattern recognition techniques in chemical engineering data analysis for the Engineering Continuing Education program of the University of Toronto's Faculty of Applied Science and Engineering." . . . Colonel **William S. Hutchinson, Jr.**, SM '49, sends word from Jacksonville, Fla.: "I am fighting to find time to keep abreast of my bills and incidental mail after a two-week reunion of my in-laws' family in Sante Fe. I hope to get together a paper for the next American Chemical Society meeting this spring in Atlanta. My theme is 'Military Deterrence Past, Present, and Future.' Wish me luck!"

From Bombay, India, **Arun N. Dravid**, ScD '70, writes: "After graduation in 1970, I spent seven years in California working with Shell Development Co. and Chevron Research Co. as a process engineer. Since returning to India in 1976, I have been employed with Humphreys & Glasgow Consultants, a design and construction organization serving the chemical process industries in India and abroad. Currently, I am managing director and CEO of the company, which employs about 400 permanent staff. We are engaged in design and construction of fertilizer, petro-chemical, heavy & light industries, minerals, and other process industries. Other distinctions include a term as president of the Indian Institute of Chemical Engineers, fellowships of the Indian National Academy of Engineering, and National Awards from the Indian Institute of Chemical Engineers in 1984 and 1987." . . . **James R. Katzer**, PhD '70, sends word: "I recently became VP for planning in Research, Engineering, and Environmental Affairs at Mobil R&D Corp. in Princeton, N.J." . . . **Steven H. Chansky**, SM '67, is president and CEO of Vaisala, Inc., in Woburn, Mass. The company manufactures meteorological and environmental measurement instrumentation and systems.

Joseph J. Paterno, Jr., SM '65, writes: "On November 6, 1990, I was appointed VP for abrasives R&D of the newly created Abrasives Division, a global business combining Norton Companies Bonded, Coated, and Superabrasives product lines." . . . Effective April 1, 1990, **David S. Swanson**, SM '53, retired as senior VP and director of the Procter & Gamble Co. in Cincinnati, Ohio. . . . **Robert H. Campbell**, SM '61, has been appointed president and CEO of Sun Co., Inc., where he has worked since 1960. Campbell held a number of positions, primarily in the refining and marketing segment, until 1980 when he became VP and later president of Sun Ship (a former company subsidiary). He was named president of Sun Refining and Marketing Co. in 1983. In 1988 he was appointed a Sun Co. executive VP, the position he held until this appointment. . . . **John Paul O'Connell**, '61, chair of the Department of Chemical Engineering at the University of Virginia in Charlottesville, has been named a Fellow of the American Institute of Chemical Engineers. In honoring O'Connell, the Institute's governing council cited his expertise as an educator specializing in materials and thermodynamics and research in physical properties of fluids, surfactant systems, and adsorption. . . . **Alan S. Feitelberg**, PhD '90, has joined the GE



R.H. Campbell



A.S. Feitelberg



A.F. Landecker

R&D Center as a chemical engineer. Feitelberg lives in Clifton Park, N.Y.

Frederic A.L. Holloway, ScD '39, of Baton Rouge, La., died on November 30, 1990. He was retired from the Exxon Corp. in New York City as VP and board chair of Exxon Research and Engineering Co. in Florham Park, N.J., and was formerly assistant general manager of Exxon Baton Rouge Refinery and Chemical Plant. Holloway was a director of Gulf States Utilities Co. from 1979-85 and a director of Construction Specialties, Inc., in Cranford, N.J. He was a former trustee of the Stevens Institute of Technology and a former VP and chair of the American Section of the Society of Chemical Industry in London, former chair of the Georgia Tech National Advisory Board and former member of MIT Energy Advisory Board. Holloway was the first group of 25 elected to the National Academy of Engineering in 1965.

XI URBAN STUDIES AND PLANNING

James R. 'Ric' Richardson, MCP '81, writes: "I was awarded tenure at the University of New Mexico School of Architecture and Planning and promoted to the rank of associate professor. The dean appointed me head of the Community and Regional Planning Program beginning in the fall of 1990. I continue my research, teaching, and practice in urban design and environmental dispute resolution." . . . **Hugh Carter Donahue**, PhD '85, writes: "I was awarded a research grant by The Japan Foundation to research high-resolution systems and Japanese technology policy. I will be a visiting scholar at Keio University's Institute for Communications Research in Tokyo from January to August 1991. I am assistant professor of journalism at Ohio State University and a research associate in MIT's Program on Communications Policy." . . . **Dietrich Garbrecht**, MCP '70, sends word from Zurich: "I am currently redesigning piazzas, streets, and waterfront for Rapperswil, a small Swiss town on the shore of Zurich Lake."

Kenneth Lin, MCP '83, reports: "I just returned from a six-week vacation touring Zimbabwe, Zambia, Botswana, South Africa, Lesotho, Swaziland, Namibia, Mauritius Island, Reunion Island, and Great Britain, traveling whenever possible by train for the adventure and to better see these countries. I've now visited 95 countries! I'm currently working as the manager of Car Overhaul Documentation at the New York City Transit Authority, providing technical documentation support for the world's largest subway-car overhaul program. We've been overhauling more than 2,400 subway cars costing in excess of \$1.2 billion during the past six years. Graffiti has been completely eliminated from all 6,200 railcars as a result. As this program is winding up in New York, I'm now looking forward to my next challenge in transportation/planning. If anyone has any ideas or opportunities, let me know!" . . . **Langley C. Keyes**, PhD '67, and Denise DiPasquale have edited *Building Foundations: Housing and Federal Policy* (University of Pennsylvania Press, 1990). The book contains a series of papers

on national housing policy. According to the book cover, "this comprehensive study of housing policy in the U.S. is the result of the MIT Housing Policy Project (1987-1989), which was directed by the editors. The project assembled leading scholars and practitioners from across the country, representing a wide range of perspectives, to assess the key policy issues of housing availability, affordability, and quality."

Anita E. Landecker, MCP '82, director of California Programs for Local Initiatives Support Corp. (LISC), has been appointed to the board of directors of the Los Angeles Branch of the San Francisco Federal Reserve Bank, beginning last January. Landecker has been director of California Programs with LISC in Los Angeles since 1987, guiding 121 loans, grants, and equity investments totalling over \$60 million, with which the nine-year old, non-profit institution finances affordable housing and economic development ventures. Prior to 1987, she was consecutively executive director, director of planning, and planner for the Los Angeles Community Design Center. Earlier, she was housing analyst for the Joint Center for Urban Studies at MIT and Harvard and a legislative analyst for the Franklin Institute in Washington, D.C.

Glynnis Altieri Trainer, MCP '79, of Trumbull, Conn., died on December 12, 1990 in Yale New Haven Hospital; she was 36. Trainer was an economist at CitiBank in Manhattan, where she had worked since 1980.

XII EARTH, ATMOSPHERIC, AND PLANETARY SCIENCES

Kristine Holderied, SM '88, sends word: "I am continuing to work as an oceanographer (Navy Lt.) at the Naval Eastern Oceanography Center in Norfolk, Va." . . . **Lieutenant Colonel Carlton L. Bjerkaas**, SM '77, writes in from O'Fallon, Ill.: "I am currently the assistant chief of staff at the Air Weather Service in the U.S. Air Force."

XIII OCEAN ENGINEERING

Commodore W.J. (Bill) Broughton, NE '61, writes: "I have retired from the Canadian Navy after 37 years of service. My last appointment was as director general of Maritime Engineering and Maintenance, the senior naval engineer in the Canadian forces. My home is in Ottawa, Ontario." . . . **Captain John C. Scalzo**, OCE '73, writes in from Alexandria, Va.: "I am an active duty Navy captain and an engineering duty officer. My duty assignment is deputy director of the Ship Maintenance and Modernization Division in the Office of the Chief of Naval Operations." . . . **William Rogalski, Jr.**, SM '70, reports: "I am still in charge of the Gibbs & Cox, Inc., Washington division and have recently been promoted to a VP."

XV MANAGEMENT

C. Mitch Dmohowski, SM '90, sends word: "I'm in sunny Southern California building ships and surfing to my heart's content." . . . **James D. Elkind**, SM '89, writes: "Kathy Raymond and I married in the pouring rain last September. Having a wonderful time in rural Massachusetts. Teradyne continues to challenge and excite me. Looking forward to good snow this winter!" . . . **Nicholas S. Fiekowsky**, SM '78, now works at American Airlines as principal technologist in Sabre Computer Services. . . . **Elizabeth Selke Munn**, SM '84, is an operations manager at Applied Materials, a semiconductor equipment manufacturer in Silicon Valley. . . . **Kenneth P. Fox**, SM '78, writes that he has changed jobs. He is working for United Technologies as director of the new corporate office overseeing development

of the new headquarters building in Hartford, Conn. . . . **Mark S. Rangell**, SM '89, reports: "I am now working as an associate business unit manager for CIBA Consumer Pharmaceuticals in Edison, N.J. My wife Shari and I recently celebrated the birth of our first child, Brian Howard, on December 5, 1990."

Gordon Low, SM '85, writes: "I left McKinsey in Cleveland for a line management VP position in a \$3 billion food company in my hometown, Calgary, Alberta. Laurie just started our second semester of teaching our four kids at home." . . . **Mark Javello**, SM '86, reports: "I started and am president of Aqua Terra Environmental Services Corp., headquartered in New York City. The company is entering its third year and is continuing to grow. Aqua Terra's primary business is providing environmental audits of property for financial institutions, real estate management firms, and potential purchasers. The company also performs regulatory compliance audits for manufacturing and industrial concerns. I currently live in Chatham, N.J., with my wife Jamie." . . . **Henry B. Barg**, SM '73, sends word: "I have become a partner in the fundraising consulting firm of Wein Associates in Brookline, Mass. My responsibilities will be to broaden the client base within the educational sector, as well as providing counsel to nonprofits in health and human services, the firm's traditional market niche." . . . **Mark F. Hayward**, SM '85, writes: "After several years at N.A. Philips and then helping found a technology start-up, I am now director of Ultrasound Marketing at Ciradian, Inc., a small public medical company. My wife, Mila, and I and our 2-year-old daughter, Kara, now reside in San Ramon, Calif."

Kate Subak, SM '87, writes: "I moved to Toronto in March 1990 and have joined McKinsey & Co. as an associate. I also have learned to feather a canoe and wear sensible shoes, but so far have resisted the charm of curling." . . . **Robert B. Hedges, Jr.**, SM '84, sends word from Wilmette, Ill.: "I recently assumed responsibility for the MAC Group's financial services consulting practice 'West of the Hudson.' As a result, I know now the pleasure of Los Angeles to Miami 'red-eyes.' More importantly, our second son, Ryan Jarvis, was born on October 22. Mom and child are doing great, and our 20-month-old son, Connor, is learning to adjust to no longer always being the center of attention." . . . **Guillermo Siman**, SM '87, is an assistant VP for planning & research with Citibank in Miami, Fla. . . . **Jay Paap**, PhD '79, reports: "In April 1990 I joined Ampersand Ventures, a venture capital firm focusing on providing venture management and advisory services to fund investors and corporate venturing executives. I work with corporations in designing and implementing venture programs concerning strategic alliances, corporate venture capital, and venture spinoffs. My wife, Lou, received a BSN from the University of Massachusetts at Boston in December 1989, and is a clinical nurse at Beth Israel Hospital."

Ronald M. Kirshbaum, SM '62, is living in Highland Place, Ill., and is VP and general manager of the Alberto-Culver Co.'s Food Service Division. . . . **Sidney Kriger**, SM '89, reports: "I am enjoying my position as a product marketing specialist at Xylogics, Inc. Jill and I are still living on Beacon Street in Brookline and welcome hearing from those of you still in the area. Jill was recently admitted to the Massachusetts Bar and is practicing at Hale and Dorr." . . . **Stephen N. Gerson**, SM '89, was recently appointed medical director of the Behavioral Health Care Division at Peer Review Analysis, Inc., a medical consulting and utilization management firm. . . . **Gerald A. (Gary) Taylor**, SM '78, reports: "I have returned to Boston as part of the expansion of Incentives Research, Inc., the economics and financial consulting firm (energy markets) I started with **Paul R. Carpenter**, PhD '84, in 1983. Fellow Sloan graduates **Frank Graves**, SM '80, **Jamie A. Read, Jr.**, SM '80, and **Sarah E. Robinson**, SM '80, are also with the firm. I moved from Los Angeles

with my wife, Susan, and children, Matt (6), and Rebecca (3), to Lincoln, Mass., in December 1989, and we have enjoyed very much our first year back on the East Coast."

Federico (Dickie) C. Gonzalez, SM '66, sends word: "After four years as a public servant in the Cory Aquino administration of the Philippine government, I have rejoined the private sector as president and CEO of San Miguel Properties Philippines, Inc., a real estate subsidiary of the country's largest manufacturing concern. A former government official could not have asked for a better deal! Especially in these difficult times. While the country is in crisis, causing hardships to real estate ventures that are on stream, we see in this crisis *opportunities* for this young and aggressive company." . . . **Youichi Ohshima**, SM '90, writes: "I am planner of development projects at Takenaka Corp. in Japan. We are now involved in a landscape project of Huge Kansai, the new international airport. I am writing a book on Japanese waterfront development based on my MIT thesis." . . . **Thomas J. Greaves**, SM '90, has been promoted to VP of Daratech, Inc., a CAD/CAM, CAE, and GIS market research and technology assessment firm. . . . From London, **Leon Liebman**, SM '67, writes: "I'm still active in private V.C. work and have become a director of Optical Data Corp., Starch-Intra-Hooper, Maid, Ltd., Financial and Commodity Computer Systems, Ltd., Rolf Fyne Associates, Ltd., and National Digital Corp."

Peter David Englander, SM '77, sends word from London: "I was married to Leanda in 1985 and our son, Simon Jonathan, was born September 27, 1990. I am director for Alan Patricof Associates, a leading U.K. venture capital fund manager." . . . **Paul S. Basile**, SM '75, writes: "After more than nine years in Geneva, Switzerland, we have moved to London. And, for the first time in my career, I work for a U.S. company—Computer Sciences Corp. My role as director of marketing for CSC Europe is to help develop the image and reputation of CSC throughout Europe so the business will grow. We are pretty successful so far and I am having a great time. One of the CSC subsidiaries is Index, a management consultancy based in Cambridge (Kendall Square), with close ties to Sloan." . . . **V. Kamal Meattle**, SM '67, reports: "I am currently involved in setting up an export-oriented flexible packaging project for food, medical, and industrial applications. Our son has joined the University of Southern California as a freshman and is studying computer science. We have an MIT alumni/ae club in Delhi and would like to put out a 'welcome mat' for any visiting professor from MIT on a personal or an official visit, to meet the alumni/ae here."

Brian Lando, SM '88, was promoted to associate VP at Chemical Bank in New York City last November. . . . **Fran Wells Bernitz**, SM '88, writes: "This has been an incredibly exciting year! I married Steve Bernitz on September 3, 1989 and had a wonderful honeymoon in Northern Italy. After spending two years as a business planner in FMC Corp.'s Corporate Development Department, I got promoted to Sales Operations Manager for FMC's Midwest Region Industrial Chemical Sales Group. I'm managing a group of nine and am responsible for regional market development activities for peroxygen, alkali, and phosphorus chemicals. Steve and I just bought a wonderful house in Highland Park, Ill., and are enjoying life in the Northern 'burbs of Chicago." . . . **Johannes Hoeche**, SM '88, sends word: "I married Alison Mark, SM '89, in May 1990 and I left McKinsey & Co. to work for Quantum Corp., a manufacturer of hard disk drives, as a product manager in November 1990." . . . **Dianne K. Di Sabatino**, SM '89, is a senior financial analyst in the Commercial Systems Division of Hewlett Packard Co. in Cupertino, Calif.

Jeri Nagler Robins, SM '88, reports: "Work at Welch's is busy and exciting. I've recently been promoted to assistant product manager on the Welch's Orchard line of blended, bottled, frozen,

and aseptic juice cocktails. I spent a hectic fall of 1989 renovating a house, together with my husband, Steven. I'm keeping myself occupied otherwise with community theatre involvement. I got together again recently with classmates, **Dana Norris**, SM '88, **Sadeh Vaziri**, **Greg Goldstein**, SM '88, and **Barb McKinley** for the wedding of **Jill Kurtz**. . . . **Glenn L. Sosa**, SM '88, writes: "My wife, Sheila, and I are living in Kingwood, Tex., just outside of Houston. I am still working for Exxon, U.S.A., in Houston. I encourage my classmates who will be visiting Houston to contact me, as I'm always looking for speakers to talk to the high school students in a mentor program I am coordinating." . . . **Michael Tippie**, SM '89, sends word from Seattle, Wash.: "I am an associate at Norwest Venture Capital, one of the top 10 U.S. venture funds in terms of capital under management (\$500 million). I am responsible for making equity investments in small, privately-held, medically related companies in the areas of biotechnology, medical device, medical diagnostic, and health care services. In the past year I was responsible for investing in Cellpro, Inc., a Bothell, Wash.-based medical device company that makes equipment for bone marrow transplantation, and Amer Particle Technology, a Santa Barbara, Calif., company that is developing drug delivery systems."

Matt BenDaniel, SM '88, is a customer service engineer for Ontologic, Inc., in Burlington, Mass. . . . **Anthony Asnes**, SM '88, reports: "After graduating from Sloan, as well as the New England School of Bartending, I spent a year in Aspen, Colo., pouring drinks at night and going downhill all day. Since the summer of 1989, I have been an index options market maker on the floor of the American Stock Exchange." . . . **Erik Brynjolfsson**, PhD '90, writes: "Martha Paulakis and I were married on October 7, 1990, in Buffalo, N.Y. After finishing my PhD in Sloan's Managerial Economics group, I moved over to the Information Technologies group as an assistant professor. My new wife is a physician who will be beginning a fellowship at Beth Israel Hospital. We are now looking for a new house in Cambridge, Brookline, or environs." . . . **Jeremy Jaffe**, SM '87, and **Linda Jaffe** had a baby girl, **Jessica Rose**, born on September 20, 1990. . . . **Steven J. Grossman**, SM '69, sends news from Bexley, Ohio. He was an assistant director of the Ohio Environmental Protection Agency from 1983-88. He has been executive director of the Ohio Water Development Authority since 1989 and he is the 1990-91 president of the Council of Infrastructure Financing Authorities.

Edgardo R. Sternberg, SM '87, writes in from Washington, D.C.: "Many changes since last year! In January I married Ayelet Burstin, a graduate student from Costa Rica now at Columbia's School of International and Public Affairs. I left BASF and joined the Inter-American Investment Corp. (affiliated with the Inter-American Development Bank) as an operations associate (i.e., investment officer). I enjoy very much what I am doing, which involves a lot of traveling to Latin America. Washington is a beautiful city." . . . **Gilles-Henri Dubouillon**, SM '87, sends word from Paris: "I got married to Sophie on September 1, as Cindy Hill and **Drew Brosseau**, SM '87, who joined us, can testify! Went for our honeymoon to Mauritius Island, which I warmly recommend to all of you who can stand a 20-hour trip by plane. I'm still working for the Boston Consulting Group in Paris, which right now involves studying consumer markets in Africa and the Far East. I'm looking forward to meeting my former classmates, either when they come to Paris, or when I return to Boston, probably in the summer of 1991." . . . From Oak Park, Ill., **Bob Gref**, SM '87, reports: "I recently left Oracle Corp. and joined a much smaller company called SmartStar Corp. I am a senior consultant and continue to do a great deal of traveling."

Lynn Rosenman Garland, SM '85, sends word from Chevy Chase, Md.: "In September Merrick and I had a baby, Rebecca Garland. Soon I'll be

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returning to my job managing E-System's Melpar division's TQM effort." . . . **Lee Dane**, SM '85, writes: "I am still teaching in the Business School at the University of South Carolina at Aiken, finding teaching tremendously rewarding. I am also working with the USC Economic Enterprise Institute to set up a Source Reduction Institute here at the university to provide technical assistance to small businesses to cut their use of hazardous substances and improve hazardous waste management—it works in other states and is badly needed here." . . . From Grosse Pointe Woods, Mich., **Steven P. De Raedt**, SM '83, reports: "I am currently a manager in GM's Financial Staff-Capital Appropriations Section in Detroit. My wife, Helen, and I are now parents of a new baby girl, Paige Catherine, who was born on Christmas Day 1990." . . . **Nancy Ritzen-thaler**, SM '84, writes: "I spent most of 1989 taking a 'sabbatical' from corporate life by mountain biking around the world. Some of my favorite places were Bali, New Zealand, and Nepal. Since returning to the U.S., I've resettled in Seattle and am now an OEM Account Manager for Microsoft. I enjoy the fast-paced style of Microsoft and am concentrating on the PDL software business. I'd love to hear from any classmates—not too many of us up here in the Northwest!"

News from **Judith A. Gilman**, SM '81, in Bethesda, Md.: "I continue to work with my husband, Carl Schwenk, in supporting the NASA Small Business Innovation Research program. Recently I wrote a guide to the program and we edited a catalogue of products resulting from the program. Both documents are part of a project to expand awareness of the program. Daughter Nancy L. Gilman, '89, (II), is trying to improve manufacturing productivity at DuPont's industrial fibers plant in Richmond, Va. I enjoy being one of her 'consultants.'" . . . Word from **Susan B. Stine**, SM '83: "I am director of planning at the University of Colorado at Boulder. Glen is VP for budget and finance for the University of Colorado system, and son, Doug, is three. We all enjoy living in the Rocky Mountains." . . . From Detroit, **Bob Clyatt**, SM '85, reports: "I have now moved back from Japan after three years there to take up a new position with Reuters as sales manager for midwest states based in Detroit. We had a nice send-off in Tokyo from **Atsushi 'Jun' Ogawa**, SM '85, **Yuki Komatsuzaki**, SM '85, **Makoto Baba**, SM '85, **Sunshik Min**, SM '85, **Daisuke Hamaguchi**, SM '85, and the gang. Any Sloanes in the Detroit area? We're buying our first house now and Wanda, my wife, is expecting our first baby in June."

Linda Marks, SM '82, writes: "I am the director of the Institute for Emotional-Kinesthetic Psychotherapy in Newton, Mass. This type of therapy integrates mind-body and psychospiritual methods anchored in a deep understanding of the heart. The Institute offers training programs. Since my book *Living with Vision: Reclaiming the Power of the Heart* (Knowledge Systems, Inc., 1989) was published, my work has taken off at a national level. I give workshops to help people reconcile their relationships with money and work, and find meaning in their lives. I also consult to healthcare organizations about the future of health care and present at a wide variety of conferences. I appeared on National Public Radio in October, and was on the Geraldo show last December. On September 9, Stanley G. Knutson, '76, (VI) and I were married." . . . **Allan R. Will**, SM '81, sends word from Atherton, Calif.: "In September, our company received U.S. FDA approval to market our primary product—a catheter that shaves and removes plaque (obstructions) from the coronary arteries. This is the first new technology approved by the FDA to treat coronary artery disease in a decade. Coincidental that a project we did at Sloan was to model the acceptance of the last new technology introduced—coronary angioplasty. Had a great visit from Leslie and **Randy Woelfel**, SM '81, in November!"

Mary E. McBride, SM '80, reports: "I am a senior VP at the First Interstate Bank of Denver

and a manager of commercial lending and corporate products. On October 11, 1986 I married Jerome J. Kashinski and in July 1990 our son, Paul Edward Kashinski McBride, was born." . . . **Walter Greenberg**, SM '80, writes: "I am still working for Citibank's Domestic Consumer Business. I transferred to Chicago in the spring of 1989 and am now director of retail distribution for the National Marketing Division. I travel frequently, especially to New York. I'd love to hear from people." . . . **Mary E. Ruddy**, SM '84, reports: "I'm the product planning manager at Peqasystems, Inc., a software development company in Cambridge. In June 1990 I married Philip Lohnes, a principle at AIRS, a Waltham, Mass., software company." . . . From Lisbon Falls, Maine, **Jon Seamans**, SM '87, writes: "I'm working in DEC's Augusta, Maine, manufacturing plant as a commodity manager. I got married in September 1989 to Carolyn Yeo, transferred to Maine in August 1990, and Carolyn gave birth to our son, David, last September! And yes, I'm still finding time to play rugby. There are not too many Sloanes up here, so if you're in the neighborhood, don't be a stranger!"

William H. Roege, SM '83, sends word from Montgomery, Ala.: "I'm working at the Air Force Wargaming Center at Maxwell AFB. I work a wide variety of scenarios from present day to 2000. I have a boy, 3, and a girl, 6, and we're enjoying Alabama. I'm looking forward to going to Europe in 1992, if the U.S. is still there." . . . **Ross J. Ely**, SM '89, reports: "**Suzanne G. Finnigan**, SM '88, and I were married on September 29, 1990, in Cupertino, Calif. Attending our celebration were **Bruce Gee**, SM '86, **Jane Ginsburg**, SM '87, **Dave Rothschild**, SM '87, **Ken Kershner**, SM '88, **Elana Lichtenthal**, SM '88, and **Steve Mankoff**, SM '88, **Drew Banks**, SM '89, **Martin Bantle**, SM '89, **L. Scott Cole**, SM '89, **Glen Davis**, SM '89, **Jeff Dickson**, SM '89, **Kenneth Farrar**, SM '89, **Greg Munster**, SM '89, **Brad Peterson**, SM '89, **Eddie Rubin**, SM '89, **Vito Salvaggio**, SM '90, and **Peter Moran**, SM '90. I am currently product manager for graphics hardware at Apple Computer, Inc., and Suzanne has founded a new voice messaging network services company."

Kevin Rowe, SM '85, sends word from London: "I recently left Credit Suisse First Boston in order to become one of the founders of Buchanan Partners. We will be managing international hedge funds in the bond and equity markets. I would welcome visits from any classmates visiting London." . . . **Christopher Thieme**, SM '88, writes: "I married Mari Matsumura on July 4, 1989, in Honolulu, Hawaii. I was transferred overseas by Citicorp in January 1990 to Indonesia where I work as a financial advisor to local corporations. . . . From New York City, **Christina T. Schoen**, SM '85, reports: "I've just returned from a 10-month assignment abroad for my bank, Creditanstalt-Bankverein, in Vienna and London. It was a great experience, especially being able to travel to Italy, Poland, and Hungary, among other places. . . . **Cathy McDonnell Carron**, SM '84, writes that she has a new baby, Emma Rose Carron, born on September 26, 1990. . . . **Max Boisot**, SM '71, is a visiting professor with the E.S.A.D.E. in Barcelona, Spain."

Mary Spyropoulos, SM '84, writes: "I married Jeff Stocker on November 4, 1989, in New York. We met on a job in Kansas City while we were both working for Andersen Consulting. Jeff is a manager in Andersen's Chicago office and I was a manager in the Los Angeles office. We have been living in the San Francisco Bay area since August 1989 (we survived the earthquake with no mishaps, but were shaken for a long time). I left Andersen Consulting in June 1990 and am currently working as a project manager in International Systems at the Bank of California. I had been with Anderson Consulting for six years—since we graduated from Sloan—and it was definitely time for a change." . . . **Janet Millenson**, SM '76, is a partner with Euclid Associates. She reports that they have moved back to the East Coast and are

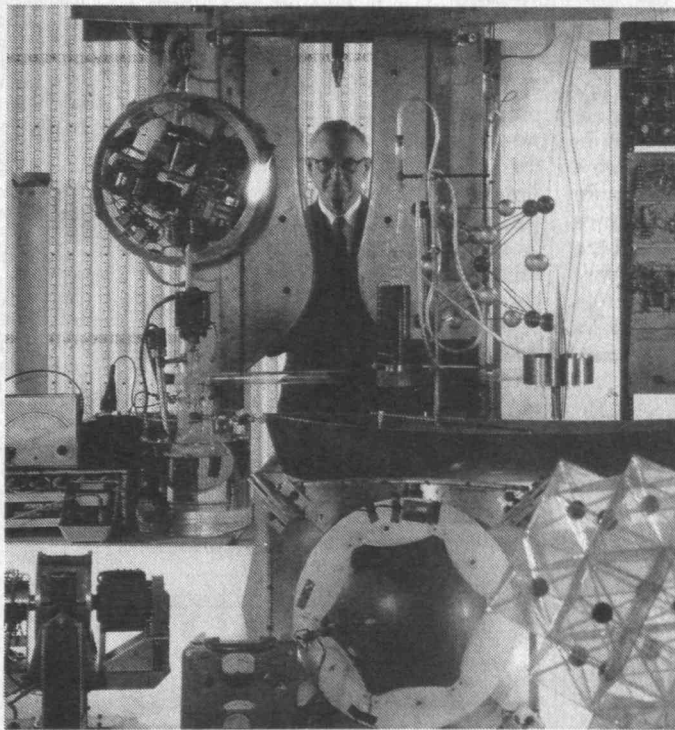
50 Years of Automated Control

MIT's Laboratory for Information and Decision Systems (LIDS) has a 50-year history of enabling engineered systems to respond to commands while still responding to their environment. Over that period, the technology has evolved so dramatically and so fast that the laboratory had to change its name twice in an attempt to adequately describe its work.

Nearly 500 staff and students from all incarnations of the laboratory assembled in Cambridge last October for a combined reunion and technical program to celebrate that rich history and consider the horizons opened up by past achievements.

The 50 years of LIDS began with a small MIT research group led by Professor Gordon S. Brown, '31, to adapt feedback principles and a servomechanism (like the system that ties together thermostat and furnace to control temperature) to position and stabilize a naval gun.

To achieve stability and consistency in such feedback systems and extend them to other military and civilian applications were the major theoretical and practical challenges that led MIT to establish the Servomechanisms Laboratory in 1940, with Brown as its head. Just down the hall, mathematician Norbert Wiener was writing his classic book on cybernetics, proposing that precise control and accurate communication were inseparable in the effective operation of a feedback system and demonstrating how to predict the future of a variable by analyzing its past. And Professor Claude Shannon, PhD '40, was developing new insights on the theory of information and its reliable transmission.



Those early days were a heady time for the Servomechanisms Laboratory. Brown was deeply committed to the idea that university-based research should tackle problems that were authentic and challenging, finish each job on schedule, and provide an atmosphere in which faculty and students worked and learned together. They produced several classic papers and books on feedback control and servomechanisms. And using the laboratory's primitive computers, faculty and students were routinely translating angular motions into electronic signals that were processed and massaged to control the movements of machine tools and the uranium fuel in a nuclear reactor and to simulate aircraft dynamics in flight training systems.

By 1959, the Servomechanisms Laboratory's activities were so broad and their applications so diverse that then-director J. Francis Reintjes proposed a new name—the Electronic Sys-

tems Laboratory. Then in 1978, the same laboratory, by then under the direction of Professor Sanjoy K. Mitter, became the Laboratory for Decision Systems. The change acknowledged the laboratory's increasing focus on the tough theoretical problems of controls with widely varying inputs and outputs that use artificial intelligence to make and to transmit sophisticated judgments continually.

The enormous technological changes of the last 50 years have literally revolutionized communications and control. When today's LIDS researchers talked about such issues as connectivity, theories of estimation, artificial intelligence, multiaccess communications, infinite-dimensional systems, and

spatial signals—even the true nature of learning—at the reunion/technical sessions, they may have left the task-oriented engineers associated with the laboratory's earliest days somewhat overwhelmed. But all understood the basic issue that continues to motivate the laboratory: how to gain an understanding of ever-more complex systems in which uncertainty is inherent.

The "fundamental problem" for the laboratory in the future, said Mitter, is this: "No adequate conceptual foundations yet exist for dealing with the inherent complexity" of modern systems.

To the lab's founder Gordon Brown, who first struggled with managing uncertainty in the vastly simpler but no less vital systems of the 1940s, the assembly sent a message: "Your judgment in your choice of . . . research . . . and your enthusiasm and boundless energy for 'getting the job done' have inspired us all." □

1901-1991

Otto C. Koppen Aviation Pioneer

Professor Emeritus of Aeronautical Engineering Otto C. Koppen, '24, died on January 20. He was 90 and lived in Osterville, Mass.

A pilot and designer of airplanes, Koppen was an authority on stability and control in aircraft, who anticipated in the early 1930s the importance of systems engineering. He taught at MIT from 1929 until his retirement in 1965. Among his students were four future admirals and two future generals, including General James Doolittle, ScD '25, who in 1942 led the first U.S. bombing sortie against Japan.

Koppen took a leave of absence from MIT during WWII in order to work on the design of bombers, cargo planes, and gliders that carried airborne infantry into battle.

From 1925 to 1928, Koppen designed airplanes for Henry Ford. He later designed and built the first fixed-rudder, easy-to-fly plane, called the Skyfarer, which allowed pilots to concentrate on two controls—ailerons and



elevators—rather than three.

Three decades of aeronautical design led to the helioplane, a STOL (short takeoff and landing) aircraft which needed 100 yards or less to take off and which could climb at 20 degrees, cruise at 172 mph, and land at 28 to 35 mph. Koppen test-flew the prototype himself in 1949. His design was considered such a milestone that the first helioplane was hung in the Smithsonian. About 300 of its successors saw military and civilian service worldwide and were prized by medical missionaries working in bush country with primitive airports. The planes were made by Helio Aircraft Corp. of Bedford, Mass., a company Koppen founded with Professor Lynn Bollinger of the Harvard Business School, a fellow pilot and an expert on aviation and airport management.

For many of the past 20 years, Koppen piloted a plane daily (weather permitting) out of Barnstable Municipal Airport in Hyannis. □

residing in the D.C. area. . . . Eugene Lee, SM '89, is a director of product planning at Beyond, Inc., in Cambridge. . . . From Redwood Shores, Calif., Nimish Mehta, SM '87, reports: "We're enjoying our new—and first—baby more than we could've imagined! Her name is Shibani, and she is six months old (on January 25, 1991). We bought a brand new home on top of a hill—great view! I'm now managing development and marketing for 30 percent of Oracle Corp.'s business."

Jean-Paul Richard, SM '64, sends word from Vienna, Va.: "I am a principal consultant for Input, Inc., and I'm enjoying the opportunity to analyze the info services market from a new vantage point, after having been 'in the trenches' in this business for the past 25 years." . . . Paul E. Greenberg, SM '88, is a senior associate for Analysis Group, Inc., located in Belmont, Mass. His book, *The Practice of Econometrics: A Computer Handbook Using Micro TSP* (Addison-Wesley, 1990), accompanies *The Practice of Econometrics: Classic and Contemporary* (Addison-Wesley, 1990), a book by Ernst Berndt, a Sloan School professor. . . . Robert F. Sherman, SM '59, is president of Colortran, Inc., in Burbank, Calif. . . . Simon John Dyer, SM '86, is pleased to announce the birth of Helen Julia Dyer, born on September 8, 1990—a new sister for Emily, Jack, and George.

Cathy A. Mirecki, SM '87, sends word from Summit, N.J.: "I left Exxon Treasurer's Department in February 1990 and joined the American Express Co. in corporate finance." . . . Willmore Aileen, SM '89 is with the Consumer Banking Group at the Chemical Bank in New York City. . . . Beth Krasna Casella, SM '83, has been living in Bangkok, Thailand for over a year. She started her own consulting firm to do investment analy-

sis, feasibility studies, technology transfer, and joint-venture assistance. She is enjoying living in a warm climate. . . . Lee Tesconi, SM '83, writes: "I was recently married to Carol Snow. Mark Regan, SM '83, was in the wedding party, and Ted Dumbauld, SM '83, Deb Tessier, SM '83, and Jeff Shames, SM '83, were in attendance. We live in Medfield, Mass. I am a VP at Bane Boston Capital, investing subordinated debt and equity in LBOs." . . .

Simeon Chow, PhD '87, has been named an assistant professor of marketing at Boston University's School of Management. Chow, who specializes in advertising research, had been teaching at the University of South Carolina since 1986. He has published frequently, and his articles have appeared in *Advances in Consumer Research* and *Studies in Applied Mathematics*. He is member of the Institute of Management Science, the Association for Consumer Research, and the American Marketing Association. . . . Mary P. Rowe, special assistant to the president and adjunct professor of management, recently received an award from the New England Corporate Consortium for AIDS education. She was cited for her article "Fear of AIDS" published in 1986 by the *Harvard Business Review*. . . . Susan W. Bailey, SM '87, has been hired as the Ipswich, Mass., town accountant. She has worked as a budget systems analyst at the New England Life Insurance Co. and most recently as a senior consultant in Price Waterhouse's management consulting division in Boston.

The Alumni/ae Association has been notified that David E. Labson, SM '63, of Purchase, N.Y., died on November 23, 1990. There was no further information provided.

Sloan Fellows

Pascal F. Tone, SM '79, reports: "I have joined the Individual Asset Management Group at the firm of Neuberger & Berman in New York City." . . . Jorge Daniel Kuropatwa, SM '87, is managing director of Organizacion Hanli in Buenos Aires, Argentina. . . . Thomas J. Kelly, SM '70, sends word from Huntington, N.Y.: "I recently completed an interesting assignment with the Space Station Program—our next major manned space project." . . . Cheryl L. Clarkson, SM '90 writes: "In September 1990, I started a new job as the president of Abiodent, Inc., a subsidiary of Abiomed, Inc., in Danvers, Mass. Abiodent is a new company devoted to the diagnosis and treatment of periodontal disease. It develops, markets, and manufactures its own products. The parent company, Abiomed, is a medical research and manufacturing company with products such as the first implantable artificial heart, cardiac support equipment, and medical lasers. I accepted the presidency in July, but took the summer off to spend time with my new daughter, Danielle, who was born in March 1990 during my Sloan fellowship."

From London, Roger Garside, SM '72, sends word: "I founded Garside, Miller Associates in 1990 to provide consultancy to emerging securities markets. Current contracts include advising on the development of the Budapest Stock Exchange, the Cyprus Stock Market, and exchanges for Malta and Gibraltar." . . . William H. Straub, SM '81, reports: "I am chief of radiology at Presbyterian University Hospital and associate chair of the Department of Radiology at the University of Pittsburgh School of Medicine. I was recently named a Fellow of the American College of Radiology and a director of Pennsylvania Capital Bank." . . . Scott R. Bayman, SM '80, is VP for Consumer Services at General Electric Appliances. He had been the Louisville, Ky.-based company's general manager of Range Products.

. . . Michael H. Nelson, SM '77, is a psychiatric associate at the Merrimack Valley Counseling Association in Nashua, N.H. He continues as president of Psychiatric Medicine Associates in Billerica, Mass.

David Chittick, SM '69, has been awarded the EPA's 1990 Stratospheric Ozone Protection Award "in recognition of exceptional contributions to global environmental protection." Chittick, AT&T's environment and safety engineering VP, was recognized for "his substantial, continuing contributions to environmental matters, especially the reduction of chlorofluorocarbons that are depleting the stratospheric ozone layer." Chittick is chair and cofounder of the Industry Cooperative for Ozone Layer Protection (ICOLP), an association of industrial users of CFCs to coordinated the worldwide exchange of information on CFC alternatives. Under his direction, ICOLP members have joined to combine resources, research, and funds to accelerate protection of the earth's ozone layer by developing alternatives to CFC solvents in electronics manufacture, according to an AT&T news release. Chittick was also a member of the U.S. Mission to the People's Republic of China regarding stratospheric ozone and the special U.S. delegation to the Soviet Union and Hungary regarding CFCs. He is the chair and a founding member of the Environmental Management Roundtable.

The Alumni/ae Association has been notified of the following deaths: Kentaro Inohara, SM '89, of Yokohama City, Japan, on January 11, 1991; Cyrus V. Helm, SM '58, of Houston, Tex., on October 8, 1990; and Orville E. Henning, '35, of Erie, Pa., on February 29, 1990.

Senior Executives

Abdul Majid Khan, '84, writes: "I transferred to my new assignment last year. I'm now the chief executive of the Engineering Design and Construction Department of National Fertilizer Corp. in Lahore, Pakistan." . . . Stephen Graham, '83,

is living in Luxembourg. He has left Citicorp and joined KPMG Peat Marwick Consultants, S.C. . . . **Richard Standaert**, '89, reports: "We moved to London in January 1990, following my promotion to exploration manager for the Oryx U.K. Energy Co. In my present position I am responsible for all oil and gas exploration outside the U.S. (for Oryx). Prior to the move we lived in Dallas, Tex." . . . **Jong-Yong Yun**, '88, sends word: "I am with Samsung Electronics as CEO, where I am in charge of the consumer electronics business."

Janez Skrubej, '89, reports from Ljubljana, Yugoslavia: "I have been very busy with my firm, the ITC Group, which I started at the beginning of 1990. It is an international management consulting firm helping businesses use information technology more efficiently." . . . **Edmund G. Astolfi**, '73, is director of the Technology Transfer Group for National Executive Service Corps in New York City. He had been a consultant in Greenwich, Conn. . . . **Gerald H. Sandler**, '81, has become president of Grumman Data Systems located in Woodbury, N.Y. He had been senior VP of the Data Systems Division at Grumman Corp., also in Woodbury. . . . **David J. White**, '86, has been promoted to VP for engineering at Kaman Aerospace Corp. Formerly VP for engineering technology, White will oversee all engineering, excluding the Tucson, Ariz., operations of Kaman Aerospace.

Management of Technology Program

John Harrison, SM '83, of Boston's Parsons Brinckerhoff, is working on a megaproject. Last January he wrote that he had spent the past eight months commuting to Dallas, Tex., where his firm is leading a joint venture organization to design and build the superconducting supercollider (SSC) conventional facilities. With over 70 miles of tunnel and four large detector halls, as well as campus buildings, site and infrastructure improvements (roads and utilities) to plan, design and build, this endeavor requires a sophistication of project management and controls unique to such large projects. He further wrote that his MOT training has been invaluable. . . . **Hakon Myhre**, SM '83, is now managing director at Goltens Dubai in the United Arab Emirates. . . . **Julian Nikolchev**, SM '83, is now a general manager at Teknekron Corp. in Menlo Park, Calif. . . . **John Hallal**, SM '85, has two appointments. In addition to his position as manager of programs for Burlington's GE Automated Systems Department, he is also business manager of Burlington Center Operations.

Kim-Chinh Tran, SM '86, is now manager of Security and Waste Management Systems for Gamma-Metrics in San Diego. . . . **Remolo Ciola-Filho**, SM '87, is assistant to the president at the Instituto Cientificos CG, Ltd. He is leading an electrochemical instrumentation development. . . . **Ginny Moszkowicz**, SM '87, recently received a promotion to manager of Quality Assurance and Industrial Engineering in the Apparatus Division of Eastman Kodak Company. . . . **Masafusa Atsuta**, SM '88, of Hitachi, Ltd. is now senior engineer. . . . **Steven Bello**, SM '88, was recently elected to the IBM Academy of Technology. He is now a senior technical staff member. . . . **Masahiro Yamazaki**, SM '88, is now corporate VP for R&D at Zeon Chemicals USA, Inc., of Louisville, Ky. . . . **Tommy Gardner**, SM '88, became financial management officer for Navy Comptroller at Naval Operations for the Pentagon in Washington, D.C. He wrote in January that he recently completed a deployment on the USS *Norfolk* that included port calls in Belgium and Canada. . . . **Thomas J. Greaves**, SM '90, of Daratech, Inc., in Cambridge was promoted from senior analyst to VP last November.

Mathias G. Kothe, SM '90, has a new position as of October 1990. At Siemens Solar GmbH in Germany, he is now manager of International Coordination. Earlier this year his firm acquired the largest firm in the photovoltaic business, ARCO Solar, and Mathias finds it a challenge

providing for a beneficial cooperation of these two very different companies. . . . **Reinhold Gueth**, SM '90, of ABB Process Automation, Ltd., in Switzerland is now department manager. The company supplies process computer systems for industrial plants. . . . **Barbara Proud**, SM '90, is a consultant to the CEO of the Department of State Services in Perth, Australia. Her responsibilities include the provision of whole-of-government information systems and state I.T. . . . **Kip R. Steveley**, SM '90, has been manager of Powertrain Components Engineering at Delco Moraine NDH Division of GM Corp. since last July. . . . **L. Craig Wall**, SM '90, of the USAFG is now a systems engineer/tech expert of Maintenance Systems at Wright Patterson Air Force Base. . . . **Mark West**, SM '90, is a technology consultant at IBM. . . . **Hajime Yamada**, SM '90, is senior coordinator and supervisor at NTT R&D Information, Patent and Licensing Center in Musashino, Japan.—Fay Wallstrom, Management of Technology Program, MIT Rm. E56-304, Cambridge, MA 02139.

XVI AERONAUTICS AND ASTRONAUTICS

Robert A. Summers, SM '54, sends word from Potomac, Md.: "I was recently appointed chief of the Nuclear Safeguards and Testing Division at the U.S. Arms Control and Disarmament Agency in Washington, D.C. I am responsible for technical relations with IAEA (Vienna) and future policy in nuclear testing limitations (to prevent proliferation of nuclear weapons)." . . . **Stan Rosen**, SM '70, writes: "I retired from the U.S. Air Force in November 1990. I joined Hughes Aircraft Co.'s Space & Communications Group as manager of Advanced Planning. I'm currently VP for Public Policy with the American Institute of Aeronautics and Astronautics." . . . Colonel **Llewellyn "Doc" Dougherty**, SM '68, is now serving as the technical assistant to the director of DARPA. . . . **James S. McDonnell, III**, SM '59, has retired as VP of McDonnell Douglas Corp. in St. Louis, Mo.

XVII POLITICAL SCIENCE

Arthur B. Corte, SM '75, writes: "I was elected to the New Hampshire House of Representatives where I serve on the Committee on Education. I hope to increase the use of video and computers in the learning process." . . . **James Short**, '73, a research associate at the Sloan School of Management, has received this year's Richard Beckhard Prize given annually by the Sloan School and *Sloan Management Review* for "an outstanding paper on the subject of planned change and organizational development." Short, of the Center for Information Research, won the prize with Thomas E. Davenport of Ernst and Young for an article the two wrote for the summer 1990 issue of the *Sloan Management Review*. The article, entitled "The New Industrial Engineering: Information Technology and Business Process Redesign," examined ways in which information technology can be used to redesign business processes. The \$1,000 prize was established to honor Professor Richard Beckhard, one of the founders of the organizational development field, on his retirement from the Sloan School.

XVIII MATHEMATICS

Fred J. Hickemell, PhD '81, writes: "Since 1985 I have been living in Hong Kong. As head of the Mathematics Department at Baptist College here I am learning to face the challenges of strengthening our applied mathematics teaching and research. Alumni/ae and professors passing through Hong Kong are encouraged to come visit. This city is an exciting place to live—

everything is developing so fast." . . . From Dedham, Mass., **Dana S. Fine**, PhD '89, writes that he is an assistant professor at Southeastern Massachusetts University. . . . **Jan L. Boal**, PhD '59, reports: "I retired in June 1990 after 37 years of teaching—the last 21 at Georgia State University. Our Inn, the Veranda, was selected 'Inn of the Year 1990' by Pamela Lanier's Inn Book." . . . **Robert Lax**, PhD '73, sends word from Baton Rouge, La.: I have just had a textbook, entitled, *Modern Algebra and Discrete Structures* published by Harper Collins."

Hal J. Sadofsky, PhD '90, reports: "I'm living in Baltimore, Md., working for the math department at the Johns Hopkins University as an assistant professor." . . . **Steven Orszag**, '62, of Princeton University has been named the recipient of the 1991 Otto Laporte Award. The citation reads, "For his many contributions to computational fluid dynamics, especially to the numerical investigation of nonlinear instability mechanisms in fluids, the onset of chaotic motions, and the transition to turbulence; and for his contributions to the development of spectral methods of the solution for the Navier-Stokes equations."

XXII NUCLEAR ENGINEERING

Vincent P. Manno, ScD '83, sends word from Sudbury, Mass.: "In May 1990, I was granted tenure and promoted to associate professor of mechanical engineering at Tufts University." . . . **Claudio Almeida**, PhD '76, reports: "I have decided to stay two more years in the International Atomic Energy Agency in Vienna. I have moved to the Safety Assessment Section of the Division of Nuclear Safety. I will be working mainly on a new project on safety of WWER power plants in which we intend to review the design of old and new plants." . . . Lieutenant Colonel **James A. Kee**, 'NUE '73, retired from the military in June 1990. He is now program manager for SDI survivability technology at Booz, Allen & Hamilton, Inc., in Arlington, Va. . . . **Martin Becker**, PhD '64, reports: "I was appointed the Victor P. Clarke Professor of Engineering and dean of the College of Engineering at the University of Miami. I was formerly associate dean of engineering for research at Rensselaer Polytechnic Institute."

TPP TECHNOLOGY AND POLICY PROGRAM

Richard Davies, SM '84, and Josie Stein were married on January 26, 1991. . . . **Kevin B. Fitzgerald**, SM '86, is currently in the doctoral program in public policy and management at the Wharton School of the University of Pennsylvania. . . . **Jeff Dieffenbach**, SM '89, is a project manager at IBIS Associates, Inc., a materials engineering consulting firm in Wellesley, Mass. His responsibilities are primarily with the automotive and recycling industries focusing on manufacturing cost analysis and cost-performance tradeoffs. The company was founded in 1986 by MIT Professor Joel P. Clark, ScD '72 (III). The president is John V. Busch, PhD '87 (III). . . . **Scott Pace**, SM '82, recently joined the Department of Commerce as the deputy director of the Office of Space Commerce, focusing on national policies affecting commercial space business. . . . **Seth D. Hulkower**, SM '86, has joined the New York office of Putnam, Hayes, and Bartlett, an international economic and management consulting firm. He will focus on the firm's energy and environmental practice areas. . . . **Bobby B. Gillenwater**, SM '80, has been admitted as a partner in the law firm of Barnes & Thornburg, effective January 1, 1991.—Rene Smith for Richard de Neufville, MIT Rm. E40-252, Cambridge, MA 02139.

Deceased

The following deaths have been reported to the Alumni/ae Association since the *Review* last went to press:

- Joseph M. Isenberg**, '13; December 6, 1990; Chestnut Hill, Mass.
- James B. Reber**, '14; November 25, 1990; Johnstown, Penn.
- Wilfred A. Wyld**, '16; January 1, 1991; Bradenton, Fla.
- Thomas R. Taber**, '20; December 9, 1990; Brainerd, Minn.
- Albert S. Genaske**, '21; December 19, 1990; Fryeburg, Maine.
- Arthur L. Bennett**, '22; November 4, 1990; Newburyport, Mass.
- Gilbert M. Fox, Jr.**, '22; November 25, 1990; Wollaston, Mass.
- Paul S. O'Brien**, '22; November 9, 1990; Baton Rouge, La.
- C. Willis Stose**, '22; October 6, 1990; Daytona Beach, Fla.
- Allen Wescott**, '22; December, 1990.
- James R. Fisher**, '23; December 26, 1990; Danvers, Mass.
- Hou Y. Hsu**, '23; 1987; Vancouver, BC, Canada.
- Otto C. Koppen**, '23; January 20, 1991; Osterville, Mass.
- Scott F. Nicoll**, '23; September 6, 1990; Sausalito, Calif.
- George Raymond Lehrer**, '24; January 30, 1991; Weston, Mass.
- Edward S. Taylor**, '24; February 2, 1991; Lincoln, Mass.
- Douglas A. Nettleton**, '25; August 29, 1990; Dallas, Tex.
- John Buss**, '26; December 23, 1990; Mississauga, Ontario, Canada.
- Manuel Gorriaran**, '26; December 26, 1990; Providence, R.I.
- Henry W. Jones**, '26; April 23, 1990; Philadelphia, Penn.
- Theodor C. Muller**, '26; November 20, 1990; Westport, Conn.
- George A. West**, '26; November 17, 1990; South Dartmouth, Mass.
- Walter F. Blake**, '27; January 1, 1991; Plympton, Mass.
- M. Mailloux Coren**, '28; November 16, 1989; Eastchester, N.Y.
- James S. Morse**, '28; December 21, 1990; Hillsborough, Calif.
- James J. Nargis**, '28; October 1, 1990; Fresno, Calif.
- Doris J. Derbyshire**, '29; November 4, 1990.
- Robert T. Flaherty**, '29; December 5, 1990; Waltham, Mass.
- Charles Clarke Keely**, '29; August 14, 1990; Los Angeles, Calif.
- Thomas W. McCue**, '29; January 29, 1991; Newton Highlands, Mass.
- George E. Barker**, '30; October 31, 1990; McHenry, Ill.
- Alan C. Bemis**, '30; January 7, 1991; Concord, Mass.
- Edmund Lee Gamble**, '30; November 28, 1990; Marston Mills, Mass.
- James George**, '30; 1985.
- Francis J. Noonan**, '30; 1987; Lynn, Mass.
- Arthur D. Roberts**, '30; September 16, 1990; Miami, Fla.
- George L. Williams**, '30; September 5, 1990; Santa Monica, Calif.
- Joseph J. Alkazin**, '31; December 18, 1990; Carlsbad, Calif.
- Philip W. Bourne**, '31; December 19, 1990; Bedford, Mass.
- Standish L. Deake**, '31; December 20, 1990; Woodstock, Vt.
- Willis Fleisher, Jr.**, '31; June 13, 1990; Flemington, N.J.
- Thoresby P. Slack**, '31; November 22, 1990; Fort Lauderdale, Fla.
- Francis D. Weeks**, '31; November 6, 1990; Highland Park, Ill.
- Henry S. Duncan**, '32; October 30, 1990; Norwood, Mass.
- Warren S. Little**, '32; November 6, 1990; Newbury, Mass.
- George H. Sherwood**, '32; November 25, 1990; Andover, Mass.
- Edward P. Hutchinson**, '33; December 16, 1990; Wayne, Penn.
- Roger L. Putney**, '33; December 2, 1987; Rockland, Mass.
- Samuel F. Allison**, '33; November 11, 1990; Walnut Creek, Calif.
- Robert H. White**, '33; November 30, 1990; Torrington, Conn.
- Beaumont H. Whitton**, '33; April 24, 1990; Charlotte, N.C.
- Muriel Bliss Wilbur**, '33; 1987; Arlington, Mass.
- Ewald H. Andresen**, '34; January 3, 1991; Reading, Penn.
- Richard Bell**, '34; December 14, 1990; Scottsdale, Ariz.
- George E. Best**, '34; October 4, 1990; Baltimore, Md.
- Wilbert P. Frantz**, '34; October 22, 1990; Tamworth, N.H.
- Paul C. Grueter**, '34; December 18, 1990; Milton, Mass.
- Gilbert G. Lorenz**, '34; October 15, 1990; Highland Beach, Fla.
- Eugene O. O'Brien**, '34; September, 1990; Elmhurst, Ill.
- W. Arthur Smith, Jr.**, '34; October 26, 1990; Tenants Harbor, Maine.
- Edgar Sviki**, '34; October 17, 1990; Cape Coral, Fla.
- Lun K. Chew**, '34; January 24, 1990; New York, N.Y.
- Dexter J. Clough II**, '35; December 18, 1990; Bangor, Maine.
- Edward J. Collins**, '35; September 1, 1990; South Easton, Mass.
- James Preston Conner**, '35; November 11, 1990; Campbell, Calif.
- Sherman Trowbridge Leavitt**, '35; June 20, 1990; San Pedro, Calif.
- Louis A. Young**, '35; December 9, 1990; Milton Mills, N.H.
- Frank S. Gregory, Jr.**, '36; November 30, 1990.
- Frederick F. House**, '36; August 21, 1990; Englewood, Fla.
- Horst Feistel**, '37; November 14, 1990; Dennisport, Mass.
- William F. Tiernan, Jr.**, '38; November 27, 1990; Narberth, Penn.
- Roy W. Carlson**, '39; November 21, 1990; Oakland, Calif.
- John T. Francis**, '39; December 28, 1990; New Bedford, Mass.
- Frederic A.L. Holloway**, '39; November 30, 1990; Baton Rouge, La.
- Alexander R. Laker**, '39; October 4, 1990; Glendale, Calif.
- Verne N. Osmundson**, '39; November, 1989; Greensburg, Kan.
- Craig Smyser**, '39; June 12, 1988; Houston, Tex.
- Marshall Stubbs**, '39; November 20, 1990; Raleigh, N.C.
- Raymond Wexler**, '39; October 15, 1990; Silver Spring, Md.
- W. Kenneth Bodger**, '40; November 13, 1990; Laguna Beach, Calif.
- Richard C. Brown**, '40; October 7, 1990; Palo Alto, Calif.
- Mamerto E. Cruz**, '41; December 11, 1990; Deptford, N.J.
- Glen A. Guernsey**, '41; January 21, 1990; Brunswick, Maine.
- Robert H. Winalski**, '41; December 23, 1990; Richmond, Va.
- Albert C. Zettlemoyer**, '41; January 27, 1991; Bethlehem, Penn.
- James F. McClelland, Jr.**, July 12, 1990; Grosse Pointe Farms, Mich.
- Marshall J. McGuire**, '42; January 14, 1991; West Hartford, Conn.
- John T. O'Connor**, '42; February 13, 1988; Washington, D.C.
- John H. Thacher, Jr.**, '42; September 10, 1990.
- Maurice R. Evans**, '43; November, 1990; Halifax, N.S., Canada.
- Leonard W. Kates**, '43; December 7, 1990; Providence, R.I.
- Solomon S. Lifson**, '43; May 31, 1990; Bronx, N.Y.
- William B. Voorhis**, '43; April 19, 1990; Roswell, Ga.
- Raul J. Marsal**, '44; December 2, 1990; Col del Valle, Mexico.
- Luigi J. Russo**, '45; November 30, 1990; Springfield, Penn.
- James E. Finigan**, '46; December 31, 1990; Concord, Mass.
- Hugh W. Byfield**, '47; 1990.
- William Enkeboll**, '47; November 10, 1990; San Rafael, Calif.
- Arthur W. Galusha**, '47; December 13, 1990; Charlottesville, Va.
- Roger S. Holcolmb**, '47; July, 1990; Hendersonville, N.C.
- Eli Perry**, '47; October 21, 1989; Clayton, Mo.
- Michael T. Rosar**, '47; November 11, 1990; Jasper, Ga.
- David V. Collins**, '48; October 28, 1990; South Hadley, Mass.
- William E. Hardy, Sr.**, '49; December 1, 1990; Pickens, S.C.
- Robert H. Burke**, '50; December 29, 1990; Oswego, N.Y.
- Stanley H. Hillyer**, '50; August 1, 1969; New York, N.Y.
- Nancy Keating Hauser**, '51; 1980; Bradford, Penn.
- Richard W. Mascolo**, '51; January 6, 1988; Manhattan Beach, Calif.
- John H. Wassel**, '51; July 24, 1990; Miami, Fla.
- Michael J. Duggan**, '52; November 2, 1990; San Jose, Calif.
- William S. Holden**, '52; August 28, 1990; Concord, N.H.
- James W. Astrue**, '54; September 2, 1986; Milton, Mass.
- Everett H. Gerrish**, '55; December 7, 1990; Kennebunkport, Maine.
- William B. Nicoll**, '55; June 4, 1978.
- Ward C. McCallister**, '56; May, 1990; Glen Ellyn, Ill.
- William T. Lang**, '57; December 29, 1990; Winchester, Mass.
- Cyrus V. Helm**, '58; October 8, 1990; Houston, Tex.
- Warren A. Welsh**, '60; October 6, 1990; Fulton, Mo.
- Alvin H. Dammig, Jr.**, '61; December 8, 1986; Glens Falls, N.Y.
- Natalio Kerilenevich**, '61; March 5, 1986; Lexington, Mass.
- Richard C. Samuelson**, '61; August 7, 1990; Palm Springs, Calif.
- James R. Melcher**, '62; January, 5, 1991; Lexington, Mass.
- David E. Labson**, '63; November 23, 1990; Purchase, N.Y.
- Sekharipuram N. Seshadri**, '63; February, 1986; Bombay, India.
- Alexander D. Gold-Pitegoff**, '67; October 18, 1989; Brookline, Mass.
- Vincent C. Oxley**, '67; September 4, 1990; Waltham, Mass.
- Rafael Cintron**, '70; 1989; San Juan, P.R.
- Irene du Pont III**, '70; December 23, 1990; Hockessin, Del.
- Lawrence P. Goldstein**, '74; January 26, 1991; Belmont, Mass.
- Harry A. Gammerdinger**, '78; October 15, 1990; Memphis, Tenn.
- Glynnis Altieri Trainer**, '79; December 12, 1990; Trumbull, Conn.
- Joao Fabio de Carvalho Serapiao**, '88; November 20, 1990; Sao Paulo, Brazil.
- Kentaro Inohara**, '89; January 11, 1991; Yokohama City, Japan.
- Sun-Jae Kim**, '90; November 21, 1990; Cambridge, Mass.

Domino-How

Mark Lively believes that it would be helpful if I include the graduation year (if given) of each respondent. Although I am not against this in principle, I am worried about the extra space involved. In fact, in order to save space, I am only listing first initials and only listing each responders name once per issue rather than for each problem solved (see the "other responders" section below). Recall that the column now must fit within one page, less than half its previous size. I felt that reducing from five problems to three and economizing on the space for names was better than reducing to two problems.

Nob. Yoshigahara sent me a 1991 calendar containing photos of some of his "glass puzzles." Readers wishing information on these and other Nob. puzzles should write to him at 4-10-1-408 Iidabashi Tokyo 102 Japan.

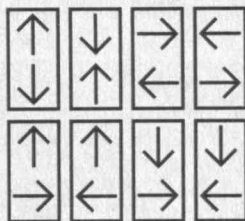
Problems

M/J 1. A computer-related problem from Robert High who has a Black Box with two buttons: RED and GREEN. The Black Box can be in any of three states, one of which is known as SUCCESS. (High suggests brave souls try three non-SUCCESS states but we have space only for solutions to the original problem.) When the box is in the SUCCESS state, a bell rings. Pressing either button leads to a change of state. From any initial state, there is a sequence of RED and GREEN that will ring the bell.

How many such Black Boxes are there? What is the minimal number of moves guaranteed to ring the bell at least once? How good is the strategy of choosing RED or GREEN randomly, i.e., what is the expected number of moves required?

M/J 2. John Rule has a right triangle with integer sides without any common factor. When each digit is replaced by a code letter, the sides are SSWTVU, PTWTS, and RRWWQ. Break the code.

M/J 3. Nob. Yoshigahara has a strange set of 8 dominoes.



He wants you to arrange them into a 4×4 square so that four vertical, four horizontal, and two diagonal lines each contain all four kinds of arrows. The solution to this "ALHAMBRA" problem is not unique.

Speed Department

While working on Y1991, Don Gall noticed that 1991 is a palindrome; 1991 is the product of two primes, 11 and 181, that are both palindromes. When was the last year in which this occurred and when is the next year?

Solutions

JAN 1. This bridge problem is from Donald Boynton who wants to know the least number of high card points between declarer and dummy that permits declarer to make three no trump against best defense.

Perhaps it was not clear from the problem that the proposer intended that you choose all four hands. Some readers interpreted the problem to find declarer and dummy hands that could make three no trump against any distribution as well as any defense. Daniel Pratt did interpret the problem as intended and offers the following six point solution:

North

♠	Void
♥	T 9 8 7 6 5
♦	T 9 8 7 6 5 4
♣	Void

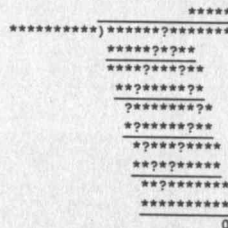
West
 ♠ A K
 ♥ A
 ♦ Void
 ♣ K J 9 8 7 6 5 4 3 2

East
 ♠ Q J
 ♥ K Q J 3 2
 ♦ A K Q J 3 2
 ♣ Void

South (Declarer)
 ♠ T 9 8 7 6 5 4 3 2
 ♥ 4
 ♦ Void
 ♣ A O T

The best West can do is to win his three top honors immediately, exit with a club, and eventually win one more club.

JAN 2. Nob. Yoshigahara sent us the following division problem in which every * is replaced by a digit and all occurrences of ? must be replaced by the same digit. Nob. attributes the problem to T. Kato and notes that as usual the leftmost * must not be 0.



There were no takers on this problem although Winslow Hartford (who is nearing 25 years of solving "Puzzle Corner" problems) declared it solvable.

Better Late Than Never

1990 M/J 4. Richard Steuer would like to see an analytic basis for the recursive relations given and has found that the asymptotic value of the "a" values is approximately 5.828.

APR 3. Ermanno Signorelli believes that proofs should be given for several of the claims made.

Other Responders

Responses have also been received from V. Patter, J. Grossman, G. Doerre, D. Wachsman, S. Feldman, J. Rudy, and R. Hess.

Solution to Speed Problem

1661 (11×151) and 3443 (11×313).

GAZETTE

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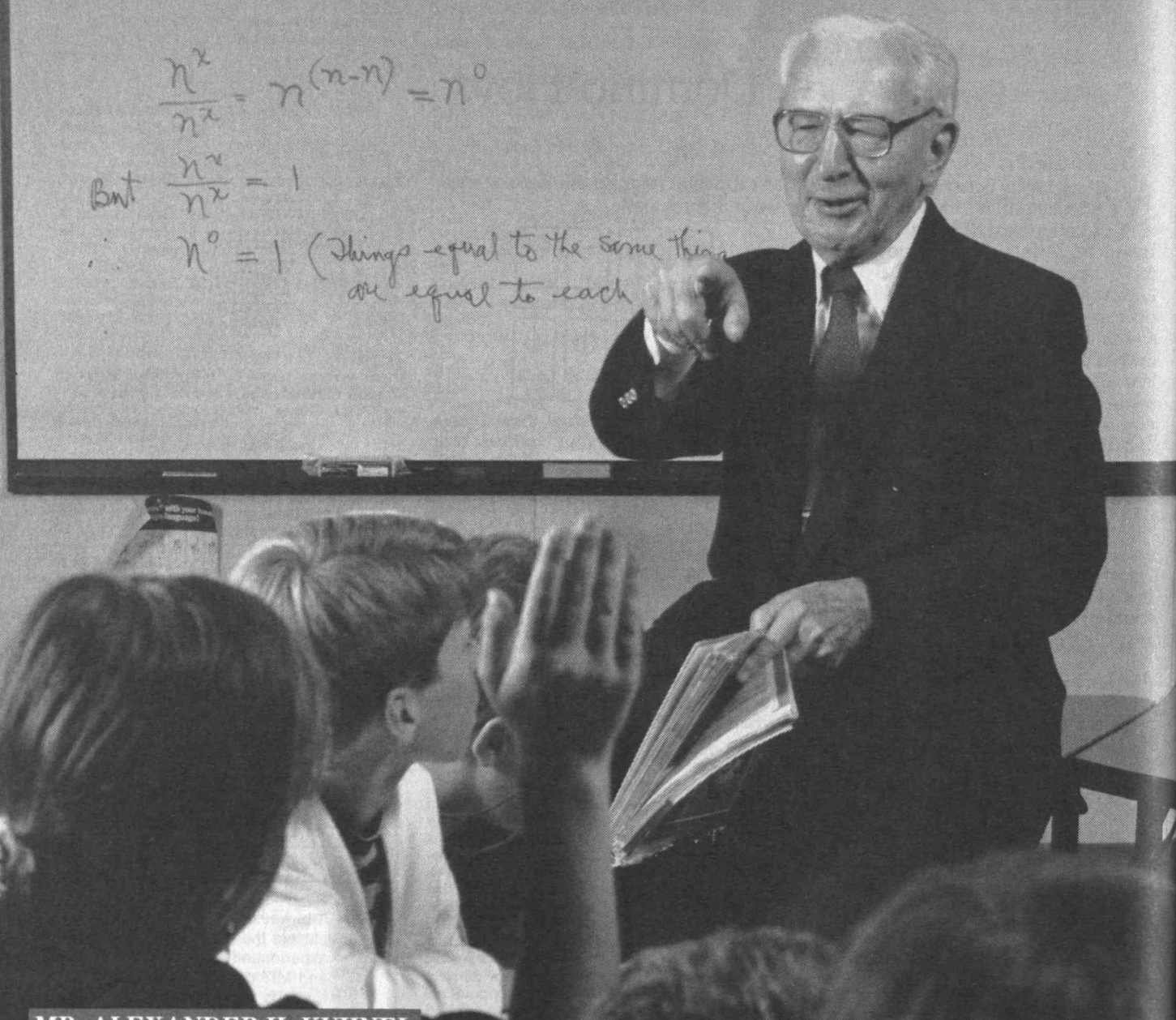
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SEND PROBLEMS, SOLUTIONS, AND COMMENTS TO ALLAN J. GOTTLIEB, '67, THE COURANT INSTITUTE, NEW YORK UNIVERSITY, 251 MERCER ST., NEW YORK, N.Y. 10012, OR TO: gottlieb@nyu.edu

MIT LIFE INCOME FUNDS



MR. ALEXANDER H. KUHNEL

HOME: Santa Rosa, California

CAREER: Mr. Kuhnelt, AR '31, worked for the Austin Company from 1944 until he retired in 1974. As manager of its Electronics Division, he developed optical and computer systems that simulated air and submarine encounters, which were used to train military pilots and submarine commanders. As consultant for Austin's Systems Engineering Division, he developed computerized inventory control systems for a wide range of clients. Although financial circumstances kept him from completing his MIT degree, he passed engineering registration exams and qualified

as a Professional Engineer in New York and New Jersey.

At the age of 65, Mr. Kuhnelt launched his second career—teaching mathematics to children as a volunteer. He brought the National Society of Professional Engineers MathCounts Program—a nationwide competition for 7th and 8th graders—to three counties in California. He now tutors talented 6th graders in the Proctor Terrace School in Santa Rosa, introducing them to algebra, geometry and trigonometry, teaching them to love math and preparing them for careers in science and engineering.

GIFT OF CAPITAL: Alexander H. (1931) and Eleanor C. Kuhnelt Fund in the Maclaurin Pooled Income Fund.

QUOTE: "Lack of funds caused me to drop out of MIT, so Eleanor and I wanted to help students who might otherwise have the same problem. It is a great pleasure to help kids become scientists and engineers."

For more information about gifts of capital, call Frank H. McGrory or D. Hugh Darden at MIT, (617) 253-3827.

Photo: Tim Davis

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A passion for perfection.SM



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“I’D BE AN
e x p e r t
ON THIS BY NOW
if I didn’t have to take
S O M A N Y
n a p s.”

SARAH BAGWELL, AGE 4, *Cardome Center, Georgetown, Kentucky*

NO, SARAH’S NOT MASTERING a new video game. It’s a computer.

What’s a four year old doing in the same room as a computer, you ask?

“Why not? It’s long overdue,” replies Debbie Highsmith, director of the new early childhood development program at the Georgetown Cardome community center. “At first glance, we look like your everyday day care center. But what our kids do here between

naps is quite remarkable.”

Pre-schoolers here are taught a second language: Spanish. And when they’re not playing



in the sandbox (still the most popular activity) they can be found in the computer room.

“By the time these children go to school they will be well prepared and ready to learn.

They’ll know their colors, numbers and the alphabet. It gives them a tremendous advantage,” says Debbie.

Giving every youngster a running



start in life is the dream of Debbie Highsmith and her dedicated staff of 25.

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Toyota is proud to have donated the \$1.3 million



Georgetown needed to start this important community and childcare center.

Naturally, we’re happy that the children of so many of our employees are benefitting from this superb day care.

But we are even more excited by the long-term value of Debbie’s vision to the country as a whole.

How great will the impact of this project be? We’re not sure.

Although we hope that some day Sarah and her trusty computer will be able to give us the answer.

TOYOTA

INVESTING IN THE INDIVIDUAL

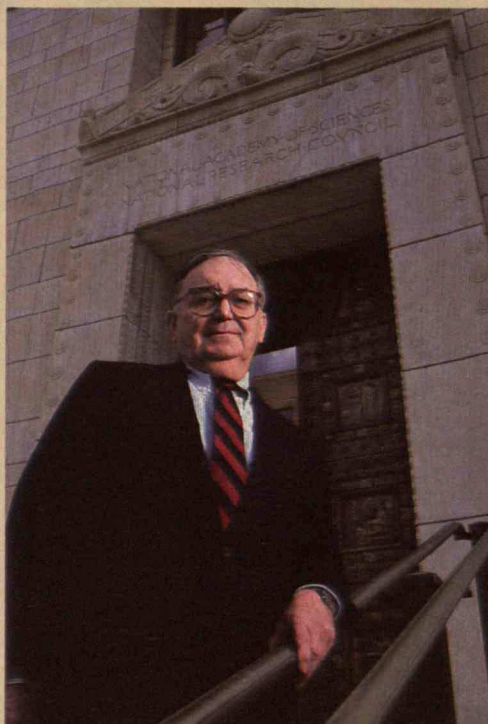
The Crisis in Science Funding

AN INTERVIEW WITH ROBERT M. WHITE

Is this the best of times, the worst of times, or what? An alien visitor trying to make sense of today's scientific funding situation would be excused some Dickensian confusion. President Bush's proposed 1992 budget would devote \$76 billion to civilian R&D—an increase of 13 percent (not accounting for inflation). National Science Foundation spending would rise 18 percent, to \$2.7 billion. The National Institutes of Health, which funds most of the country's biomedical research, would get a 7 percent increase in its basic science budget. Such growth is conspicuous in a budget that is otherwise mostly flat or shrinking.

But prominent voices from the scientific community are calling for more radical increases to deal with what they describe as a crisis. Nobel laureate physicist Leon Lederman, president of the American Association for the Advancement of Science (AAAS), has pronounced the U.S. scientific enterprise "sick," and has prescribed as a remedy the doubling of federal spending on R&D. Based on an informal survey of academic scientists, Lederman says a malaise has descended upon the research community. He paints a picture of financially struggling researchers who feel that the glory days of U.S. science are past.

Such demands have raised a firestorm of controversy. Congressman George Brown (D-Calif.), chair of the House Committee on Science, Space, and Technology, downplayed Lederman's report of malaise. "You could easily document the same level of despair among other groups," he told a recent



The President of the National Academy of Engineering says that more than money is needed to fix what ails the research enterprise.

meeting of the AAAS. Politicians, he warned, "no longer regard unlimited federal funding as a birthright for scientists."

Robert White, president of the National Academy of Engineering since 1983, remembers fondly the days when money was plentiful. In 1950, fresh out of MIT with a doctorate in meteorology, he worked at the Air Force Cambridge Research Lab. "I had my own laboratory at a young age," he recalls. "I had as much money as I could possibly want to spend. It's hard to believe that there were actually times like that."

White says that despite the outraged demands of many scientists today, support for R&D remains generous, and has risen faster than inflation over the past two decades. Overall U.S. spending on R&D, says White, "dwarfs the investments in science and engineering research of our major trading partners."

Still, he says, today's more constrained budgetary climate should lead the research community to rethink its approach to funding.

White served from 1963 to 1977 as chief of the U.S. Weather Bureau and then as the first administrator of the National Oceanic and Atmospheric Administration. Before his election to the NAE presidency, he headed a 50-university consortium that operates the National Center for Atmospheric Research.

Technology Review senior editor Herb Brody talked with White at his Washington office about the perceived crisis in science funding, and about the proper role of R&D in an industrial economy.

TR: How do you support your contention that research in this country is, overall, pretty well funded?

WHITE: In 1990, both the public and private sectors spent \$150 billion for the support of R&D across the board, not just on academic research. That's a 61 percent increase over the preceding decades in constant dollars. And even if you discount the very large fraction of the R&D expenditure by the federal government for defense, the amount is still larger than any of our industrial partners or competitors. The country has over 200 research universities, and 35 of them have research budgets exceeding \$100 million. Government laboratories have also grown remarkably. Additional resources of course would help. But I have seen no clear justification for requesting a doubling of the funds for R&D.

TR: If we have a burgeoning research community, and we spend more money than any of the countries we do business with, why do so many people feel so many scientists feel so threatened?

WHITE: The problem is simple: In academia, where the problem is acute, we appear to have too many scientists and engineers chasing too few research dollars. It is evident in statistics that indicate the low success rate that scientists and engineers have in getting their work funded. Almost all fields have suffered significant drops in the proposal success rate. At the National Institutes of Health, less than one in four approved applications actually receives support. The question is, are there too many scientists and engineers, or is there too little money?

TR: Well, which do you think?

WHITE: Some of both. It's quite clear we're going to have to live in a constrained federal budget environment. That means we're going to have to adjust the other side of the equation. And that side of the equation is

the production rate of scientists and engineers who follow careers in academic research.

TR: You have compared the production of academic researchers to the fable of the sorcerer's apprentice.

WHITE: Yes. In the Disney movie *Fantasia*, a sorcerer's apprentice sets in motion a multiplying army of brooms carrying buckets of water that become a flood. In a way, the same thing has happened here: the nation has loosed a flood of scientists and engineers who seek careers in academic research. Over the decade from 1977-1987, the number of doctoral scientists and engineers in academic research and development increased 65%, from approximately 94,000 to 155,000. This is a phenomenal increase.

TR: And this has gotten out of control?

WHITE: At any given time a faculty member may have about five doctoral students under his or her tutelage. Assuming that two complete their work each year, then even if only one-third of the graduates go into academic research, there is about a 15-fold replication over a teaching career of 20 years. Faculty members train many students in their own images. And many of these students aspire to remain in academia, doing research and teaching. Each seeks funding support and funding is unable to keep pace. That fundamentally constitutes the problem.

TR: What should these PhDs do instead?

WHITE: One would think that if we're producing scientists and engineers at the PhD level, we have a marvelous opportunity to upgrade the quality of our science and engineering staffs in industry and government laboratories. Government laboratories are having a very difficult time attracting top-level talent. And the economic effectiveness of many industries is large-

Additional resources would help, but I have seen no clear justification for requesting a doubling of R&D funds.

Like
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and engineers
who seek
careers in
academic
research.

ly dependent on their technological capabilities. So there are outlets for scientists and engineers other than to continue doing research in academia.

TR: Can't PhDs often get more money working for industry than for a university? What further incentives are needed to get them to leave academia?

WHITE: Industry does not actually pay much of a premium for PhDs. In fact, over a working lifetime in industry, a scientist or engineer with a doctorate doesn't make that much more than one with a master's degree. This suggests that the economic incentives are weak. Industry and government might take this opportunity to upgrade its entire technological work force.

TR: You faced that choice personally, didn't you—you got a meteorology PhD, and then left academia. What persuaded you to make the move?

WHITE: Well, my professor, Henry Houghton, sat me down—he was a wonderful human being, head of the Department of Meteorology at MIT—and we had a long talk. He said the department was not going to be hiring many people, but that there was a big world out there with great opportunities for people well-trained in meteorology. He advised me to make a move and set out on a different kind of career. I was a little upset by that, because I had my eyes set on staying in academia. But it was good counsel.

TR: So more professors ought to be nudging their students out of the ivory tower?

WHITE: Yes, but you have to have the receptors out there. There has to be some place where the young PhD can go and get a rewarding and exciting job.

TR: I can see why an excess of PhDs in academia would be bad news if you are one of them. But it would seem to be great for the nation—it becomes a buyer's market for research talent, and the taxpayer is the buyer.

WHITE: That's true—especially if scientists and engineers put their minds toward advancing the economic effectiveness of this nation. Many universities are quite prepared to do that. MIT is a good example, trying to combine its manufacturing program with its management school in its Leaders for Manufacturing program. And you see that happening at universities across the board. Many universities recognize some of the central problems in this country, and they are seeking to help. This great pool of trained people that we've been producing is a marvelous opportunity for us to begin to increase technological capabilities across the board, whether in government agencies or in industry.

TR: Since industry benefits from doing R&D, companies would seem to have an incentive already to hire more scientists and engineers. What further incentives are needed?

WHITE: I think industry has to recognize that they need to build up their R&D capabilities. Obviously, some industries invest substantially in R&D. But you can find many industrial sectors that have invested minimally—the construction industry, for example, and machine tools. As a result, U.S. industry loses market share. The U.S. machine tool business lost much of its market share because of a failure to conduct R&D and to exploit R&D that had been taking place at universities and elsewhere.

TR: You would think that these industries would have a market incentive to preserve themselves. Since that incentive seems not to have worked, what else should be done?

WHITE: There's no silver bullet. It is not solely a matter of R&D. We need economic policies that will encourage industry to make investments in R&D. And we need to improve the management of technology. The recent book by Daniel Roos and others at MIT—*The Machine That Changed the World*—documents beautifully some of these technology management issues. Also, government needs to play a larger role in the support of generic tech-

nologies important to our industry and the economic effectiveness of the country in the global marketplace.

TR: Do you think the government is starting to take on that role?

WHITE: Yes, I'm encouraged. I'm very pleased with what I see as a gradual change of view in the government—for example, the recent issuance by the White House Office of Science and Technology Policy of their first technology policy. I'm also pleased with some of the new directions in the proposed FY 1992 budget.

TR: Particularly —?

WHITE: I'm pleased that the high-performance computing initiative has received an increase of some \$150 million, or 30 percent, to help establish American preeminence in this field. Another good sign is the increase in the budget for the Advanced Technology Program in the National Institute of Standards and Technology, which provides grants for development of generic technologies. The NSF's investments in engineering and science and technology research centers have been additional steps in the right direction. We're beginning to see the emergence of efforts by the federal government to focus funding on areas of technology that are important to the long-range industrial health of this country.

TR: So it's an industrial policy?

WHITE: Hardly. We need to define our terms. Former Secretary of Defense Harold Brown, when asked how he would distinguish between an industrial policy and a technology policy, suggested using as an example the development of U.S. agriculture. In the early days, the government supported agricultural research and extension services—a technology policy. Government expenditures supported generic technologies that could be used by farmers to increase their productivity. Today, the federal government provides large subsidies for agriculture for a variety of reasons—to pro-

tect some growers against foreign competition, to ensure adequate income for farmers, and to achieve other national objectives. That's industrial policy.

TR: Focusing on specific areas of generic technology means either adding significantly to the overall budget, which you admit is unlikely, or taking money away from other areas.

WHITE: If we are to live with a constrained budget, some criteria for funding priorities need to be established. I'm suggesting that one important criterion has to be the contribution of R&D investments to the economic growth of this country. Accepting this criterion puts you in a position to rank investments, and would suggest focusing money on key technology areas.

TR: If you're going to focus on near-term economic effectiveness, that would seem to leave basic research out in the cold.

WHITE: I am not suggesting that economic effectiveness be the only criterion. We also need to ensure the education and training of talent, and we need to invest funds in the continuing search for new knowledge. Also, I am not drawing a distinction between basic and applied research. Let's take a generic technology field—say, optoelectronics. There are many basic optoelectronic phenomena that need to be better understood. So investments in basic science that can illuminate some of the fundamental processes would be enormously helpful. And historically, developments in practical technologies have often opened up whole areas of basic research. The invention of the steam engine helped the discovery of the laws of thermodynamics, not the other way around.

TR: Still, you would seem to have little use for fields of research with only weak connections to generally useful technology—astronomy, say.

WHITE: I don't say that at all. Every society has an obligation to make substantial investments in understanding the world

The government needs to play a larger role in supporting generic technologies important to the country's economic effectiveness.

f a
*shakeout comes,
universities
will have to
decide what
to do with
faculty who
aren't
competitive
in acquiring
funding.*

about it—whether it's understanding the processes that govern the universe or fundamental human biology.

TR: But it seems inescapable that there will be winners and losers.

WHITE: There always are, even in today's allocation of resources. It is not a question of "either-or." Given the magnitude of the investment in R&D in this country, we should find it possible to focus more of our resources on areas that contribute more directly in the long run to our economic effectiveness.

TR: You've suggested creating a pool of funds by skimming 1 percent off the research budget of every federal research project.

WHITE: I was trying to illustrate what could be done by focusing even a modest amount of resources.

TR: One obvious area of enormous expenditure is defense. Sixty percent of the proposed R&D budget would be for defense. Is that too much?

WHITE: You have to realize that a lot of what the DOD classifies as "research" is not what most people would call research. A large fraction of it goes into procurement and prototyping. In fact, the Academies of Sciences and Engineering have told Congress that our public policy is being skewed because a large amount of R&D resources in the Defense Department is not what one would normally call research.

TR: Still, a large fraction of the country's R&D budget is funded by the military.

WHITE: True. Much Defense Department R&D is on "dual-use" technologies, which have civilian as well as military uses. If you look at this year's budget, there's DOD money for the high-performance computing initiative and for R&D in manufacturing, both of which are obviously dual-use. The Defense Department pumps \$1 billion a year into basic science. That's 50 percent

of the amount the NSF pumps in. A good chunk of this money goes to the universities. The Defense Department is now a big supporter of university research that is not tied to immediate defense needs.

TR: So the military is doing its share to keep research healthy?

WHITE: My view is that the Defense Department has a larger obligation than it is at present discharging to ensure the vitality of the academic research enterprise. It is one of the nation's biggest users of the output of R&D and of trained personnel, and so should be spending more money on academic basic research.

TR: You have expressed some concerns about the state of the competitive grants system for deciding where R&D money gets spent. Why?

WHITE: Our competitive grants system serves us very well. But there are some problems. For example, the peer-review system for giving out research grants is becoming overloaded.

TR: Why?

WHITE: There is an increasing number of proposals being submitted that need to be evaluated and peer reviewed. The probability of any individual proposal's success goes down. The logical thing for a grant seeker to do is to submit more than one proposal. That's what's happening, and a National Science Foundation report says the system is under stress.

TR: If the peer-review system is overloaded, is it still serving its function of making sure that funding goes to the most deserving people?

WHITE: Generally it is. One concern I have is that young investigators too often are unable to get funds for their work. The peer-review system disadvantages the young investigator who doesn't have a track record.

TR: How might we attack that problem?

WHITE: The government should set aside federal money specifically for young investigators. Some of that is happening already; for example, the National Science Foundation gives out about 100 Presidential Young Investigator awards each year.

TR: But that's not enough?

WHITE: I'd like to see more. And that program requires matching funds. NSF provides some money, then the awardee has to obtain matching funds from industry or other private sources. Another remedy would be to provide institutional grants directly to universities, which could then allocate them to young researchers.

TR: Why would that help?

WHITE: The knowledge of who the promising young scientists and engineers are is much better at the local institutional level than at the federal level. Institutions could make sure that their bright young researchers get some initial resources—some seed money—which would give them the track record they need to compete for federal funding. On the other hand, some faculty members think institutional grants are not the way to go.

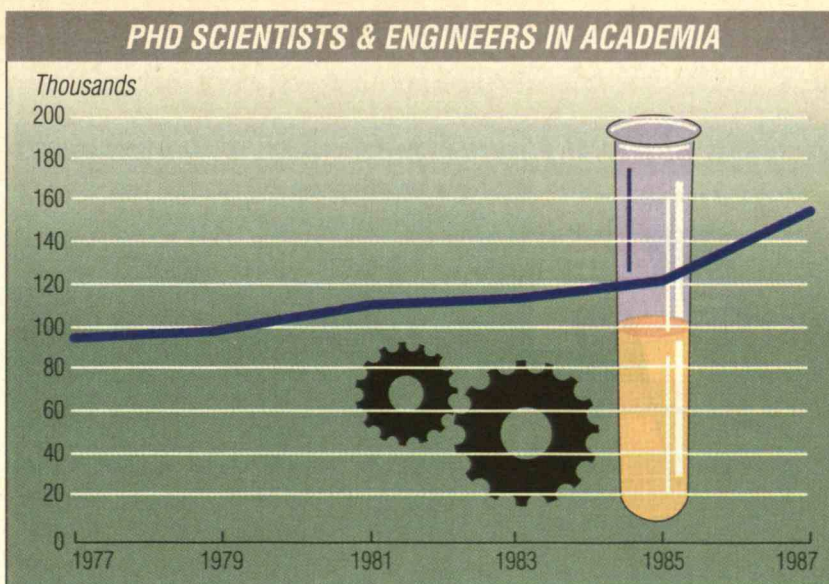
TR: What are they worried about?

WHITE: They're concerned that universities might divert the money to other research purposes—that the funds might go to inferior proposals unsuccessful in the federal grant process.

TR: What other suggestions do you have for revising the research funding system?

WHITE: The defense industry offers a useful model. Each year, defense contractors negotiate with the government a certain fraction of their overhead funds that can be used for independent research and development—IR&D. We don't do it for university contracts and grants. We ought to look into it.

TR: You have said that the R&D enterprise



is heading for a "shakeout," something like what industries go through. An industry shakeout usually means that weaker companies drop out of the market. What do you see happening in R&D?

WHITE: If the federal competitive grant process is indeed merit based, and if funds are tight, then a shakeout is inevitable. Weaker proposals aren't going to get funded. And the universities will have to decide what they're going to do with those people in the academic community who aren't competitive in acquiring funding—universities don't have enough resources to carry them for long.

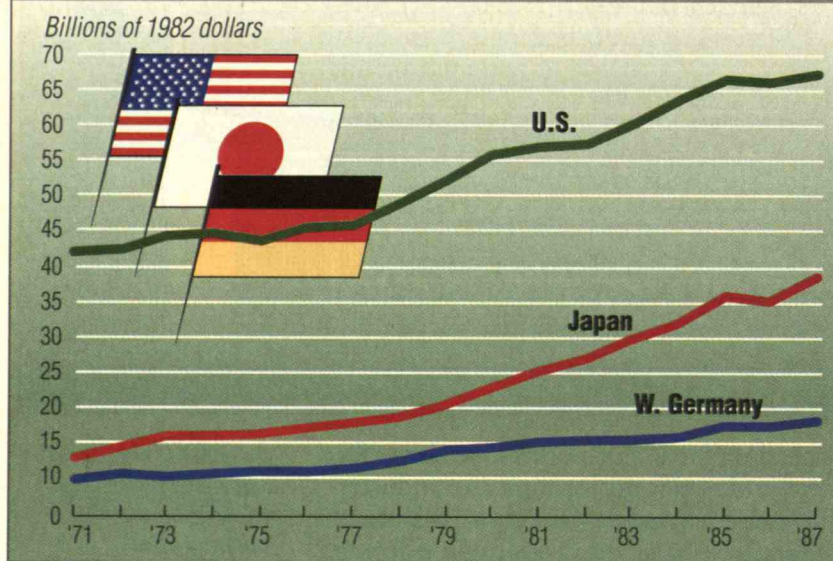
TR: Will only the best and richest universities be able to keep doing research?

WHITE: Certainly the best, but not necessarily the richest. We have a very large number of universities that maintain a broad spectrum of R&D programs. The quality of the R&D varies from field to field. It may well be that a university recognizes that one of its departments is not competitive and decides to focus its resources on areas of strength. When you have a shakeout in industry, you take a look at what your strong and weak lines of business are. You preserve the good—in fact you may build up and strengthen those areas with comparative advantages. I hope we will manage the shakeout wisely so that what we preserve are the strong elements of our R&D enterprise, wherever they may exist.

TR: How will this shakeout come about?

The growing number of academic researchers is straining the federal funding system. A shift into industry, says White, would both relieve stress on the federal R&D budget and help focus research on economically important areas.

GROWTH IN NONDEFENSE R&D SPENDING



Despite complaints from the scientific community, federal support for R&D has been growing steadily and far exceeds that of our economic competitors.

WHITE: It's going to be up to individual universities, deans, department heads and boards of trustees. I've been at universities where they have closed down departments and opened new departments—all as a function of estimates of what was important, what they could do well, and what they couldn't do well.

TR: One of the options a university has is to turn directly to industry to get funding.

WHITE: Yes, that's happening more and more.

TR: Isn't there a threat to academic independence if universities become key elements in economic development?

WHITE: As far as I can see, and from what our studies at the academies indicate, there have been few distortions of the R&D enterprise in universities as a result of industry support. I think industry has approached support of university R&D in a statesmanlike and open way. Universities have been jealous of their independence and academic freedom and are careful not to allow the availability of funds to torque their R&D programs. But the danger exists. If there is a serious shakeout, there will be a temptation to torque research programs to acquire funds. Then you have a problem.

TR: And what do you do about it?

WHITE: That's a matter that each university administration must cope with in its own way. Some universities see themselves as important elements in economic development, others are much more concerned that they remain independent places for education and training of students, and for the conduct of basic research.

TR: An international issue also arises: If the university is an element of a program to make the country more economically competitive, then it hardly makes sense to share its research with, say, the Japanese. Doesn't that subvert the principle of open communication among researchers?

WHITE: I understand that there are concerns in some parts of Congress about access of industrial competitors, like Japanese corporations, to R&D that has been supported largely by taxpayer money. That issue has especially been joined at MIT. My view is that as long as the principles of academic freedom are observed, and as long as the research program is not torqued, and as long as there is no favored access for foreign corporations, the country benefits from support of our universities by foreign corporations. It's more important for the country to have an intellectually vibrant university system than it is to try to build walls around the university. That doesn't make any sense for a university. The information it produces is available to anyone through the world pool of knowledge.

TR: Many research scientists and engineers believe that too much money is going into "megaprojects" like the superconducting supercollider (SSC) and the Human Genome Project. Do you think the balance ought to shift back in favor of individual researchers?

WHITE: I think the big-science, little-science issue has been blown out of proportion. Many of the big-science activities have been proposed by individual scientists because they needed to do frontier research. The SSC, the astronomical observatories,

and the planetary space probes are good examples. Where did the proposals for these big-science activities originate? They came from individual scientists who said, we want to work at the cutting edge of science, and we need the following facilities to do that research. Who do you think uses the telescopes? It's the individual investigators. I happen to be very familiar with the National Center for Atmospheric Research in Boulder, Colorado. That's a big center. It serves hundreds of individual university scientists who couldn't do their work otherwise, whether it's the use of an aircraft, or a very large scale computer, or a field observing system.

TR: But it is, as you've said, a zero-sum game: if you're putting money one place, it follows that you're not putting it somewhere else.

WHITE: Not in the past. The budget for individual investigators has been going up and the budget for big-science projects has been going up, too. Scientists and engineers out there would probably like to see a higher rate of growth for individual scientists than they have.

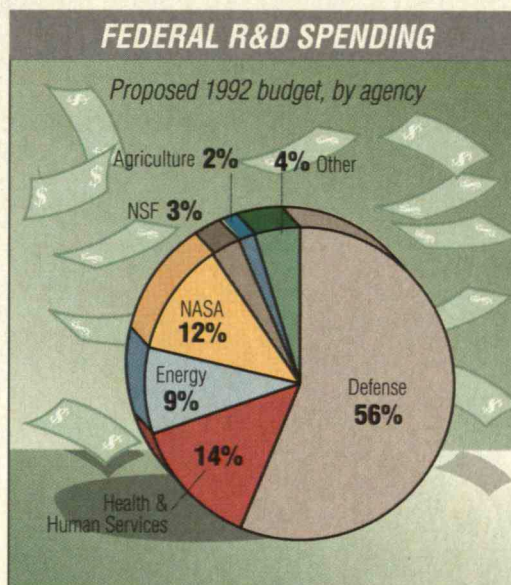
TR: Do you think the growth of "pork-barrel science" is changing the image of science in this country?

WHITE: I worry about that. With the growth of lobbying groups, and with one discipline taking on another discipline, the scientific community is in danger of looking like just another special pleader for funding.

TR: Isn't that what it is?

WHITE: But science and engineering are held in special regard because of the recognition that investments in research and development have paid off handsomely for the nation in improved health care, higher standards of living, jobs, and economic growth generally.

TR: You think research is losing that special stature?



The nation would spend \$76 billion for R&D in fiscal 1992 under the administration's proposed budget, an increase of 13% over 1991. Defense research

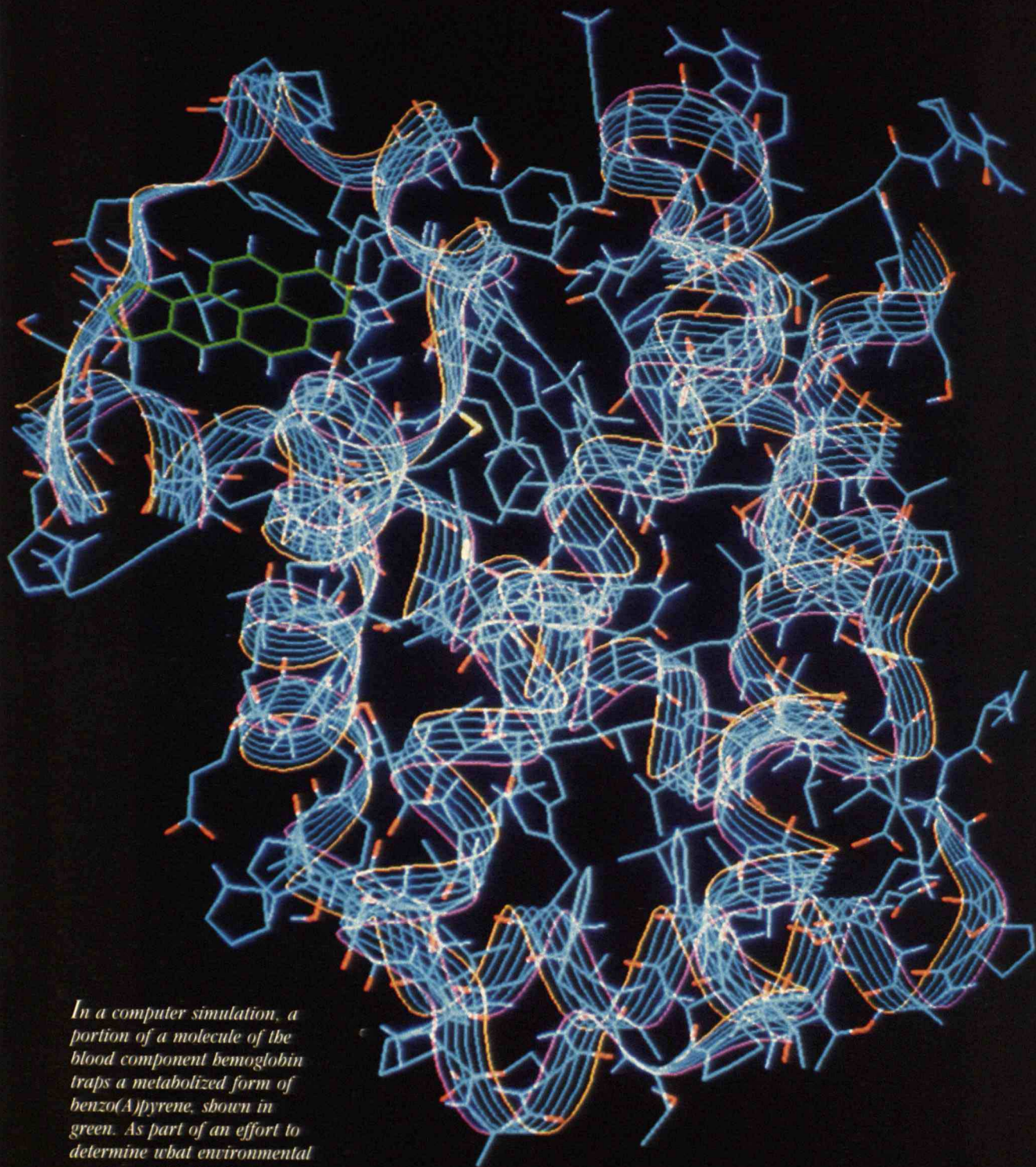
would continue to dominate the funding picture, but NASA, NSF, and the National Institutes of Health would see big gains.

WHITE: Yes, there is that danger. We have an obligation to justify our requests for funds more specifically. It is not sufficient to claim entitlement to as much money as is necessary to support every good scientist in the country because we contribute so much to the understanding of the world and to long-term economic development.

TR: When you say justification, you mean economic payback?

WHITE: Yes, in the long run, investments in research and development have to have an economic, social, or defense payback. Science and engineering research, like any other activity in this country, has a social purpose, and it must justify expenditures in ways that can be understood and lead to the social and economic betterment of the country. In using the term "social payback," I also mean that all societies have an obligation to make an investment in the search for understanding of the natural processes of our universe—the search for knowledge for knowledge's sake. ■

With the growth of lobbying groups, the scientific community is in danger of looking like just another pleader for special funding.



In a computer simulation, a portion of a molecule of the blood component hemoglobin traps a metabolized form of benzo(A)pyrene, shown in green. As part of an effort to determine what environmental compounds lead to human genetic mutations, Steven R. Tannenbaum, a professor in MIT's Division of Toxicology, is measuring amounts of chemicals that have attached to hemoglobin in this manner.

What Actually Causes Cancer

BY WILLIAM G. THILLY

With so many possible carcinogens, no one can say which is to blame for a particular cancer. But the author and his colleagues are working on a reliable approach.

THE widely held hypothesis that chemicals in the environment cause mutations that lead to cancer has sparked thousands of tests. The results have often been disseminated as public pronouncements about the potential danger of everything from peanut butter to photocopier ink. Yet this “mutagen of the month” approach to cancer has relied on testing organisms that may not respond like people to chemical exposures. Even human cells grown in test tubes can’t tell us how cells in our bodies react to all the chemicals around us. In fact, the only way we know that activities like smoking and excessive sunbathing can cause human cancer is through direct observations in people.

Given the uncertainty of most of this research, it’s no wonder the government finds it so hard to regulate a host of substances that cause cancer in lab animals. Nor is it surprising that the courts have such a tough time deciding whether individuals have contracted cancer because of particular en-

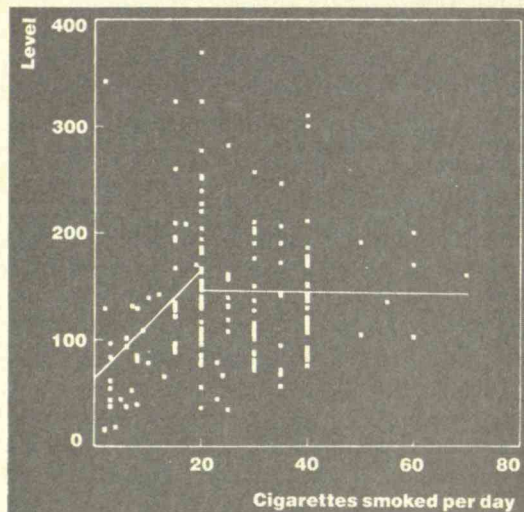
vironmental pollutants. A plaintiff must prove that the link between an illness and exposure to a substance is more probable than not—a subjective test.

At MIT’s Center for Environmental Health Sciences (CEHS), we are trying to develop technology to resolve these uncertainties. Ultimately, we think our work will allow scientists to determine which compounds have lead to which genetic changes in a certain individual. Much of our effort is aimed at discovering the causes of mutations that can lead to cancers or genetic diseases in offspring (see “Amending the Genetic Theory of Cancer,” page 53).

The research involves several steps. First, analytical chemists are trying to identify chemicals that react with components of human blood, and then measure the quantities of these compounds in people. Second, geneticists are trying to detect and measure the mutations that occur in human tissue.

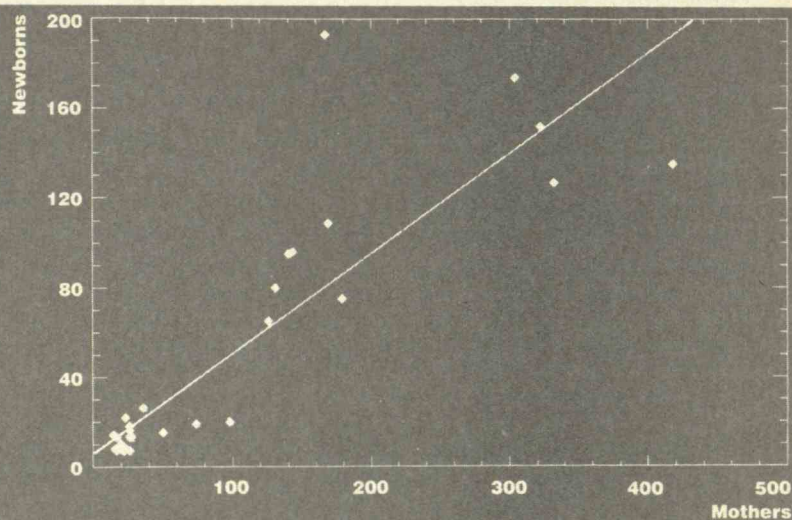
The third step is to use the chemical and genetic information to figure out which environmental

4-AMINOBIIPHENYL LEVELS IN SMOKERS' HEMOGLOBIN



Compared with nonsmokers, smokers have, on average, six times more of the chemical 4-aminobiphenyl attached to their hemoglobin. The amount of the chemical rises rapidly in people who smoke up to one pack a day and then seems to level off.

4-AMINOBIIPHENYL LEVELS IN HEMOGLOBIN OF MOTHERS AND NEWBORNS



The greater the amount of 4-aminobiphenyl in the hemoglobin of mothers, the greater the amount in their new-born children.

chemicals, if any, are responsible for the mutations detected in an individual's body. Not all mutations occur as a result of external chemicals or radiation. Some arise spontaneously, either from "typographical" errors during normal DNA replication or from reactions between DNA and chemicals produced within our bodies, such as formaldehyde and hydrogen peroxide.

The key to this research is the knowledge that each mutagen causes a specific set of mutations. By determining what mutations have occurred in a sample of human tissue, and knowing the kinds of chemicals that have bound to the tissue, we should be able to deduce which mutagen is most responsible for any genetic damage. Such information will help lawmakers improve environmental legislation and courts resolve lawsuits involving toxic chemicals.

Finding Reactive Chemicals in the Body

To perform the first step in this scheme—identifying and measuring chemicals that enter or are made in the

body—researchers measure the amounts of compounds that have reacted with components in the blood. Several are focusing on the blood-cell protein hemoglobin, since it is readily available in large quantities and circulates through all parts of the body. Most chemicals that react with hemoglobin are known to react with DNA as well and to cause damage that eventually results in mutation.

For the past decade, Steven R. Tannenbaum, CEHS associate director and a professor in the Division of Toxicology, has studied classes of chemicals that react with hemoglobin. Tannenbaum began his research with studies of a group of chemicals called aromatic amines—specifically the compound 4-aminobiphenyl, found in cigarette smoke. After metabolizing 4-aminobiphenyl, the body forms a reactive compound that chemically attaches, or adducts, to the hemoglobin molecule.

Using a series of advanced analytical techniques, Tannenbaum's group has found that smokers have, on average, six times as much 4-aminobiphenyl in their systems as nonsmokers. The amount depends on how much they smoke, and drops rapidly as they give up the habit. The researchers have also recently shown a correlation between the amount of adducted 4-aminobiphenyl in mothers and the amount in newborns, indicating that pregnant women expose their fetuses to the 4-aminobiphenyl they have metabolized.

WILLIAM G. THILLY, professor of applied biology in MIT's Division of Toxicology and Department of Civil Engineering, directs the institute's Center for Environmental Health Sciences. He also directs the Superfund Basic Research Program, which is studying the causes of genetic change in four communities north of Boston.

Tannenbaum's laboratory has also worked with polycyclic aromatic hydrocarbons (PAHs)—residues of such everyday processes as home heating, operating automobiles, charbroiling meat, and even composting organic material. Like aromatic amines, many members of this class cause genetic change in human cells. They also induce tumors in experimental animals, albeit at higher doses than people normally encounter.

To measure the amounts of PAH chemicals bound to hemoglobin, Tannenbaum has adopted a technology that takes advantage of the behavior of molecules at temperatures near absolute zero. At such temperatures it becomes far easier to distinguish among various PAH molecules. Tannenbaum's group is studying how much of a PAH called benzo(A)pyrene attaches to different individuals' hemoglobin. The researchers are trying to determine the extent to which varying lifestyles and individual metabolic processes affect benzo(A)pyrene adduct levels.

While Tannenbaum's group measures specific chemicals known to bind to hemoglobin, Klaus Biemann, another CEHS associate director and a chemistry professor, is devising a way to identify any hemoglobin-attached chemical. Biemann's group is breaking down the hemoglobin molecule with enzymes, and then analyzing the smaller pieces using two mass spectrometers working in tandem. The first one measures the molecular weights of all the hemoglobin pieces and picks out any that are heavier than normal because of attached chemicals. The second then records a structural fingerprint of each hemoglobin adduct. From this information one first deduces a chemical's placement within a hemoglobin molecule and then its identity.

Because chemicals bind to hemoglobin in trace amounts, Biemann's group has modified the tandem mass spectrometer setup to make it much more sensi-

tive. The researchers have used a principle similar to that of the infrared image intensifiers in military night-vision devices. Combined with chemical tricks to remove most of the normal, unmodified hemoglobin molecules, this method should make it possible to find chemicals attached to only 1 out of perhaps 10,000 to 100,000 hemoglobin molecules. This level of sensitivity is sufficient for human studies.

Still other research focuses on measuring chemical reactions in DNA rather than in hemoglobin. DNA reaction products are precursors to mutations. For example, a group led by Gerald N. Wogan, the director of MIT's Toxicology Division, has developed a means to measure DNA adducts of aflatoxin. Aflatoxin is produced by food molds and is a potent liver carcinogen in rats. The researchers have confirmed through extensive studies that many people in regions of China, where the incidence of liver cancer is high, have been exposed to high levels of aflatoxin.

Finding Mutations

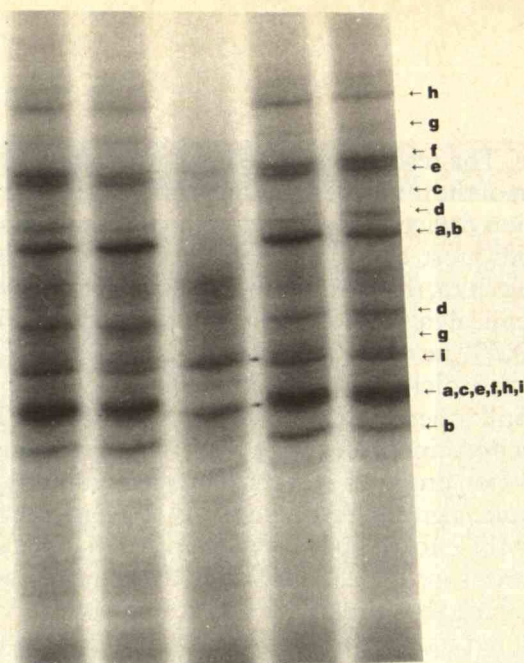
Wogan's and Tannenbaum's findings, and the anticipated information from Biemann's work, lead to a simple question. Which, if any, of the chemicals found adducted to hemoglobin are responsible for biological damage in people?

The search for an answer depends on the fact that exposing cells to a chemical causes a reproducible set of mutations known as a mutational spectrum.

Two geneticists, Seymour Benzer of Purdue University and Ernst Freese of Indiana University, discovered in the 1950s that different chemicals cause different mutational spectra in viral DNA. In the late 1970s, we reasoned that mutational spectra in human DNA might offer a way to diagnose the causes of mutation in peo-



Using two mass spectrometers in tandem should make it possible to find and identify any chemical attached to hemoglobin, even a compound bound to only one out of perhaps 10,000 to 100,000 molecules.



Lanes 1 2 3 4 5 6

To figure out which of the many chemicals that attach to hemoglobin actually cause mutations in the body, the author uses a method called denaturing gradient gel electrophoresis. After treating cells with chemicals, for example, he identifies patterns of mutations, which appear as bands in vertical lanes of DNA se-

quences. Lanes 1 and 4 show mutations that have arisen spontaneously, either during normal DNA replication or from reactions between DNA and chemicals produced within cells. The other lanes show mutations that have occurred after human cells were treated with a metabolized form of benzo(A)pyrene.

ple. We believed that a mutational spectrum found in a sample of human tissue would usually indicate the primary cause of mutation in that tissue.

This was not a popular idea when we proposed it and is not particularly well accepted today. The main objection is that mutations could have many causes. Each person is exposed to many mutagens and undergoes spontaneous mutations. By this reasoning, a tissue should contain a spectrum arising from many kinds of mutagens. It should not be possible to tease apart and pinpoint the causes.

Sure enough, if we were studying human tissues that were affected by a mixture of mutagens whose concentrations were high enough to interact, we would be unable to tell what was happening. But when we study tissues affected by mixtures of mutagens in low concentrations, we usually find that only one or two chemicals account for all the mutations. Thus we believe that the general thinking about mutational spectra—at least as it applies to low concentrations of chemicals—is wrong.

Our experiments in this area had humble beginnings. In 1977 and 1978, Ron Hites, an analytical chemist now

at the University of Indiana, wanted to find out why ordinary soot causes cell mutations. He wondered if any of the soot components he had identified by mass spectrometry were biologically active. He provided 80 soot chemicals to Debra Kaden, a graduate student in toxicology, who in turn measured the ability of each chemical to mutate cells. Hites and Kaden found that the culprit was a single compound, a minor component called cyclopenta[c,d]pyrene. They determined that another soot component, the well-known human cell mutagen benzo(A)pyrene, was not concentrated enough to create a measurable mutagenic response.

Similar examples have arisen over the years. For instance, we have found that just one chemical—methylpyrene—accounts for most of the human cell mutations caused by diesel auto exhaust.

Why is it that in so many cases the mutagenicity of a complex mixture stems from a single compound? Plotted on a bell curve, the concentrations of different chemicals in the body are broadly distributed. Thus, given the laws of probability, the second most concentrated chemical is likely to be at a significantly lower concentration than the most concentrated.

The same is true for the chemicals' molecular mutagenic activity. Since the amount of mutation is the product of the chemical concentration and the mutagenic activity, the amount of mutation caused by each chemical is also distributed broadly. Most important, one mutagen would be expected to have a much greater effect than any other compound, and could account for nearly all the mutations caused by the mixture.

Even though individuals are exposed to a vast array of chemicals and several kinds of radiation over their lifetimes, it seems possible that a single mutagen (or perhaps a very few mutagens) is the primary cause of mutations in each organ.

There is no way to test this concept short of direct human studies. In 1979, then, we set out to develop a means to observe mutational spectra in cells taken from living people.

We have used a method called denaturing gradient gel electrophoresis, which was developed in the early 1980s by Leonard Lerman, a molecular biologist at Albany Medical College. It lets us separate normal DNA sequences from mutant ones. Using an electric field, we draw a piece of DNA through a chemical "sieve." At various positions along the sieve, DNA fragments stop moving. The way we use the technique, normal DNA sequences move much farther than mutant DNA sequences, yielding a pattern we can observe.

Before applying denaturing gradient gel electrophoresis, we treat human cells with a variety of mutagens, including ultraviolet light, x-rays, and several chemi-

Amending the Genetic Theory of Cancer

COMMON thinking would hold that the death rates for almost all kinds of cancer should rise in a straight line as a person ages. After all, the more years we are exposed to mutagenic chemicals, the greater should be our chances of dying from cancer.

But the actual U.S. death rates for cancer show that the picture is not so simple. Babies are more likely to die of cancer than are 10-year-olds, even though the older children have been exposed to the world longer. And cancer death rates virtually stop rising after about age 65 to 70—so that 65-year-old Americans are almost as likely to die of lung or stomach cancer as 95-year-olds.

These paradoxes have led us at the MIT Center for Environmental Health Sciences to modify the simplest form of the accepted theory of cancer development. We agree that a human cell needs two or more genetic changes before it will start to divide uncontrollably and become cancerous. We also recognize that the necessary mutations can come from inherited cancer genes and can be acquired in other ways throughout life. But we further believe that mutations that occur early in fetal development play a critical role. Our hypothesis is that one's likeli-

hood of developing cancer at a certain age depends on three factors: the number of inherited cancer genes, the timing of any cancer mutations during fetal growth, and the timing of mutations after birth.

Consider the way a case of liver cancer might develop. Before a person is born, the liver grows from just a few cells to 45 billion cells. Meanwhile, a gene has a 1 in 10 million chance of mutating in each generation of cells. At birth, an average liver has experienced 450 mutations in every gene, including cancer genes.

In some people, however, the first non-inherited cancer mutation occurs earlier than usual. Geneticists call this a "jackpot mutation." At birth, people whose livers have undergone jackpot mutations have more cells with mutated cancer genes than other people. If, for example, an embryonic liver has a jackpot mutation at the time it reaches 2 million cells, then the newborn baby will have 20 times more cells that carry a cancer gene that has mutated than the average infant. The person who dies from liver cancer at age 25 probably acquired a jackpot cancer mutation, while the person who dies from the disease at age 65 probably did not.

We think our reasoning

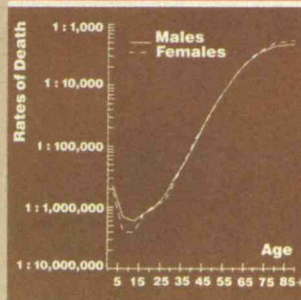
also accounts for why cancer deaths virtually plateau at age 65. When an organ has essentially reached full size, the number of cells, including those with cancer genes, does not increase any more. Individuals who die of cancer from age 65 on are born with the same average number of cells with cancer genes.

Though this simple jackpot theory appears to account for most adult cancers, it does not explain the relatively high cancer rates in young children. The likelihood of dying from liver cancer, for instance, is four times higher between birth and 4 years old than between 10 and 14 years old.

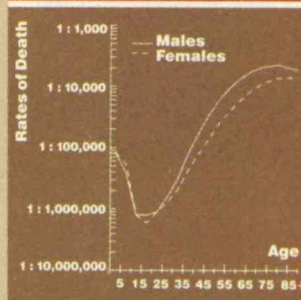
A possible explanation is that young children who die of cancer have inherited all but one of the necessary mutations. For most of these people, the final mutation takes place as they develop in the womb. As these children die, the death rate from cancer in the overall population drops for a number of years.

One question remains: why do most people not die of cancer, even if they live to be 100? Our theory argues that they have inherited so few cancer mutations that the probability of accumulating sufficient cancer mutations—jackpot plus later mutations—in a lifetime is very small.—William G. Thilly

LIVER CANCER DEATHS (AMONG U.S. WHITES)



KIDNEY CANCER DEATHS (AMONG U.S. WHITES)



The author's hypothesis of cancer development could explain why cancer death rates decline rapidly in childhood, rise sharply until age 65 or 70, then level off. This pattern is strikingly consistent for most major forms of organ cancer, including liver and kidney cancer.

The age at which one dies of cancer may depend on how many cancer mutations one inherits. The disease would strike only after one had acquired the rest of the mutations needed for cancer. According to this hypothesis, the small proportion of people who inherit all but one of the necessary mutations can be expected to die early from cancer. Those who inherit all but two such mutations tend to die from cancer as older adults. Most people require three or more additional mutations, and thus are unlikely to die of the disease. But extraordinarily high or prolonged exposures to mutagens can increase the risk.

	INHERITED CANCER MUTATIONS	PROPORTION OF NEWBORNS	PROBABILITY OF CANCER DEATH AT AGE		
			15	60	90
GROUP 1	All but 1	Less than 1%	80%	100%	100%
GROUP 2	All but 2	Approximately 30%	0.02%	12.5%	98%
GROUP 3	All but 3 or more	Approximately 70%	0%	0%	Less than 1%

The author says his center's work could lead to a rational means of regulating carcinogens and a method to help resolve toxic-chemical liability suits.



icals. Then we grow the cells in the presence of the chemical 6-thioguanine, which kills all the cells except those with mutations that occur on a particular DNA sequence on the X chromosome. By putting these human cells through the chemical sieve, we have shown that each mutagen produces a unique mutational spectrum on the DNA fragment of interest to us. The method is so sensitive that we have observed spectra even when the fraction of mutants was less than 10 in 1 million—the fraction found in the white blood cells of normal adults.

Human Studies

Our present challenge is to go from human cell cultures that we have subjected to mutagens to blood samples from ordinary people, who may have been affected by environmental contaminants. Since the mutations we can detect by using 6-thioguanine occur only once on the X chromosome, they can be present in only one or two copies per cell, depending on whether the individual is a man or a woman. That is such a low incidence

that we would be obliged to take one-pint blood samples to get a good statistical sample. Such a practice is not feasible except in limited laboratory settings.

To overcome this problem, we are studying DNA sequences that can occur as 10,000 copies per cell. Such sequences occur in the mitochondria—cell components found outside the nucleus that provide the cell's energy supply. If we succeed, we will be able to obtain a high-quality mutational spectrum from a blood sample of 0.1 milliliter—about one three-hundredth of an ounce.

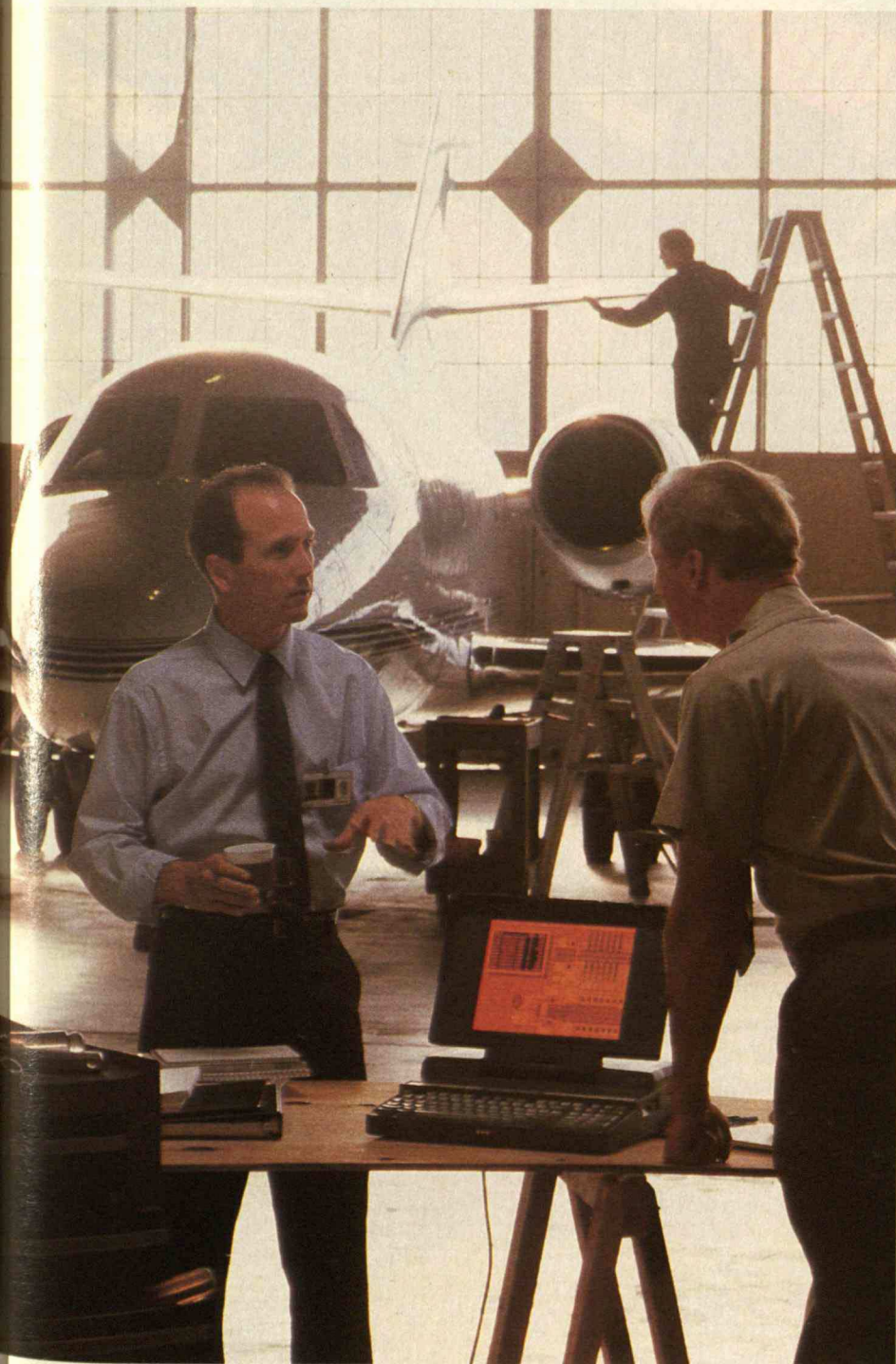
In the first human studies applying mutational spectrometry, John Hanekamp, a toxicology graduate student, is looking at mutations in white blood cells taken from four healthy adults. These experiments entail isolating DNA from blood and from cells grown in the lab for 15 generations. The direct samples should test our hypothesis that only one mutagen causes most of the mutations in a person's tissue. And the experiment with lab-cultured cells will reveal the spontaneous mutations that arise in white blood cells. That will help indicate which kinds of mutations come from the body's own processes and which come from external compounds. If Hanekamp finds mutational spectra that have not developed from spontaneous DNA changes, these spectra may contain common elements, suggesting a primary cause of mutation shared by different people.

The ability to study humans puts us well on the road to finding how environmental contaminants affect people. In the future, we should be able to combine our research on mutational spectra with Tannenbaum's, Biemann's, and Wogan's work on compounds that react with hemoglobin or DNA to identify compounds that cause mutations in particular people.

Those studies could then offer a rational means for regulating carcinogens. They could also reduce the need to perform cancer research on animals. The general approach could help resolve toxic-chemical liability cases as well. If the mutational spectrum of a substance thought to lead to cancer is found in a plaintiff's tissues, a jury will probably be able to establish that most mutations in that tissue arose from exposure to the substance. Conversely, if the mutational spectrum is absent, a court could deduce that the substance is not to blame.

For decades the public has supported basic research in environmental health sciences in hopes of identifying the hazards that cause diseases such as cancer. After all, one in every four people dies of cancer in the United States. If our approach works, we should be able to repay the public by providing means to discover what elements in the environment actually cause our mutations. ■

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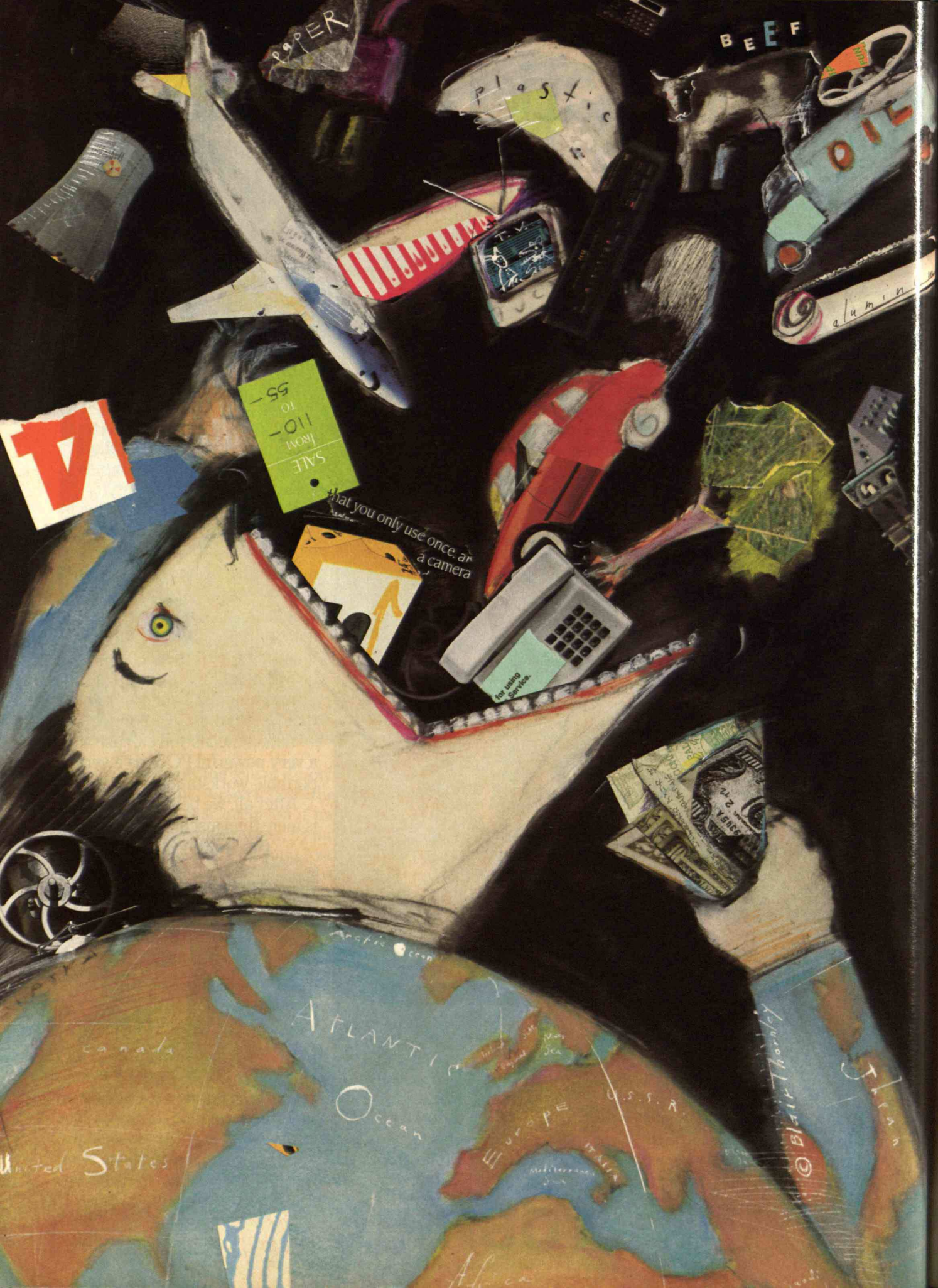


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*What level of consumption
can the earth support? When does having more
cease to add to human satisfaction?*

How Much Is Enough?



BY ALAN DURNING

EARLY in the age of affluence that followed World War II, an American retailing analyst named Victor Lebow proclaimed, "Our enormously productive economy . . . demands that we make consumption our way of life, that we convert the buying and use of goods into rituals, that we seek our spiritual satisfaction, our ego satisfaction, in consumption. . . . We need things consumed, burned up, worn out, replaced, and discarded at an ever increasing rate."

Americans responded to Lebow's call, and much of the world has followed. Consumption has become a central pillar of life in industrial nations and is even embedded in social values. The Japanese speak of the "new three sacred treasures": color television, air conditioning, and the automobile.

The affluent lifestyle born in the United States is emulated by those who can afford it around the world. And many can: the average person is four and a half times richer than were his or her great-grandparents at the turn of the century. But the wealth is unevenly spread. One billion live in unprecedented luxury, 1 billion in destitution. American children have more pocket money—\$230 a year—than the half-billion poorest people.

Overconsumption by the fortunate is an environmental problem unmatched in severity by anything except perhaps population growth. Their surging exploitation of resources threatens to exhaust or unalterably disfigure forests, soils, water, air, and climate.

High consumption may be a mixed blessing in human terms, too. Time-honored values—integrity, good work, friendship, family, community—have often been sacrificed in the rush to riches. Thus, many in the industrial lands have a sense that the world of plenty is hollow—that they have been fruitlessly attempting to satisfy essentially social, psychological, and spiritual needs with things.

Of course, the opposite of overconsumption—poverty—is no solution to either environmental or human problems. We are left to wonder how much is

enough. What level of consumption can the earth support? When does having more cease to add appreciably to human satisfaction?

Answering these questions definitively is impossible, but for each of us in the consuming class, asking is essential. Unless we see that more is not always better, our appetites will overwhelm efforts to forestall ecological decline.

The Consuming Society

The headlong advance of technology, rising earnings, and cheaper material goods have lifted overall consumption to levels never dreamed of a century ago. The trend is visible in statistics for almost any indicator. Since mid-century, the per capita global intake of copper, energy, meat, steel, and wood has ap-

proximately doubled; car ownership and cement consumption have quadrupled; plastic use has quintupled; aluminum consumption has grown sevenfold; and air travel has multiplied 32 times.

In the United States, the world's premier consuming society, the average person owns twice as many cars, drives two and a half times as far, uses 21 times as much plastic, and travels 25 times as far by air as did a person in 1950. Air conditioning spread from 15 percent of households in 1960 to 64 percent in 1987, and color televisions from 1 to 93 percent (see the chart on page 64).

Not since the '20s was conspicuous consumption so lauded as in the '80s. During that decade, microwave ovens and videocassette recorders found their way into almost two-thirds of American homes. Between 1978 and 1987, sales of Jaguar automobiles increased eightfold, and the average age of first-time buyers of fur coats fell from 50 to 26. The select club of U.S. millionaires more than doubled to 1.5 million over the decade.

Japan and Western Europe display parallel trends. Per person, the Japanese consume more than four times as much aluminum, almost five times as much energy, and 25 times as much steel as they did in 1950. They also own four times as many cars and eat nearly twice

Long before all the world can achieve the American dream, the planet will be laid to waste.

as much meat. Ironically, in 1990 a *reja bumu* (leisure boom) and concern for nature combined to create two new status symbols: English four-wheel-drive Range Rovers and cabins made of American logs.

As in Japan, West European consumption is only a notch below that in the United States. France, the former West Germany, and the United Kingdom have almost doubled their per capita use of steel, more than doubled the intake of cement and aluminum, and tripled paper consumption since mid-century. Just in the first half of the '80s, per capita consumption of frozen prepared meals rose more than 30 percent in every West European country except Finland; in Switzerland, the jump was 180 percent.

In Eastern Europe, the collapse of socialist governments unleashed a tidal wave of consumer demand that had gone unsatisfied in ossified state-controlled economies. A young man in a Budapest bar captured his country's mood when he told a Western reporter, "People in the West think that we in Hungary don't know how they live. Well, we do know how they live, and we want to live like that, too." Those living in the former East Germany bought 200,000 used Western cars in the first half of 1990 alone.

The late '80s saw some poor societies begin the transition to consuming ways. In China, a sudden surge in spending shows up in data from the State Statistical Bureau: between 1982 and 1987, color TVs spread from 1 percent to 35 percent of urban homes, the share with washing machines quadrupled from 16 to 67 percent, and refrigerators grew in prevalence from 1 percent to 20 percent of homes.

In India, an emerging middle class of perhaps 100 million members, a liberalized consumer market, and the introduction of buying on credit have led to explosive growth in sales of everything from cars to frozen dinners. The *Wall Street Journal* gloats, "The traditional conservative Indian who believes in modesty and savings is gradually giving way to a new generation that thinks as freely as it spends."

Few would begrudge anyone the simple advantages of cold food storage or mechanized clothes washing. The point is that non-Western nations are emulating the high-consumption lifestyle—and that long before all the world can achieve the American dream, the planet will be laid waste.

For one thing, supporting the lifestyle of the world's 1 billion meat eaters, car drivers, and throwaway con-

sumers requires resources from far away. A Dutch person's food, wood, natural fibers, and other products of the soil exploit five times as much land outside the country as inside—much of it in the Third World. Industrial nations account for about two-thirds of global use of steel, more than two-thirds of aluminum, copper, lead, nickel, tin, and zinc, and three-fourths of energy.

Even 1 billion profligate consumers is too much for the earth. Those in the wealthiest fifth of humanity have built more than 99 percent of the world's nuclear warheads. Their appetite for wood is a driving force behind destruction of tropical rainforests. Over the past century, their economies have pumped out two-thirds of the greenhouse gases that threaten the earth's climate, and each year their energy use releases perhaps three-fourths of the sulfur and nitrogen oxides that cause acid rain.

Beyond environmental costs, some perplexing findings throw doubt on the wisdom of consumption as a personal and national goal: rich societies have had little success in turning consumption into fulfillment. Whatever Americans are buying, it doesn't seem to be enough. Regular surveys by the National Opinion Research Center of the University of Chicago reveal, for example, that no more Americans report they are very happy now than in 1957. The share has fluctuated around one-third since then, despite a doubling of per capita spending on personal consumption.

The world's people have consumed as many goods and services since 1950 as all previous generations together. Since 1940, Americans have used up as much of the earth's mineral resources as did everyone before them combined. If such high consumption fails to provide personal fulfillment, perhaps environmental concerns can help us redefine our goals.

In Search of Sufficiency

In simplified terms, an economy's total burden on the ecological systems that undergird it depends on three factors: the size of the population, average consumption, and the technology—from clotheslines to satellite communications—the economy uses to provide goods and services.

Changing agricultural patterns, transportation, urban design, energy use, and the like could radically reduce the damage wrought by consuming societies, while allowing those at the bottom of the economic ladder to rise without causing egregious harm. Thus, efficient technology partly explains why, for each unit of energy used, Japan produces three times as much worth of goods and services as the Soviet Union. Nor-

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wegians use half as much paper and cardboard apiece as their neighbors in Sweden, though they are equals in literacy and richer in monetary terms.

But while technological change holds extraordinary potential, it is ultimately limited by the compulsion to consume. Eventually, reduced material wants will need to complement technological change. Physicist José Goldemberg of the University of São Paulo and an international team of researchers carefully studied the potential of renewable energy and greater efficiency to cut fossil fuel consumption. The entire world, they found, *could* have the quality of life Western Europe now enjoys—modest but comfortable homes, refrigerated food, ready access to public transit, and limited auto use. However, the study implicitly concludes, the world could *not* live American-style, with larger homes, more numerous gadgets, and auto-centered transportation.

Some guidance on what the American lifestyle means for the earth emerges from global patterns for three ecologically important types of consumption—transportation, diet, and use of raw materials.

About 1 billion people travel mostly on foot, many of them never going 50 miles from their birthplaces. The lack of transportation options severely hinders their ability to get jobs, attend school, or bring complaints before the government. Meanwhile, the massive middle class of the world, some 3 billion people, travels by bus and bicycle.

The automobile class is relatively small: only 8 percent of humans, about 400 million people. Their vehicles are directly responsible for an estimated 13 percent of carbon-dioxide emissions from fossil fuels, along with air pollution, acid rain, and a quarter-million traffic fatalities a year.

The automobile makes itself indispensable: cities sprawl, public transit atrophies, shopping centers multiply, workplaces scatter. As suburbs spread, families start to need a car for each driver. One-fifth of American households own three or more vehicles. Working Americans spend nine hours a week behind the wheel, and 90 percent of new cars are air-conditioned, doubling the contribution to climate change.

The auto industry's great marketing achievement has been to turn its machines into cultural icons. As French philosopher Roland Barthes writes, "Cars today are almost the exact equivalent of the great Gothic cathedrals . . . the supreme creation of an era, conceived with passion by unknown artists, and consumed in image if not in usage by a whole population which ap-

propriates them as . . . purely magical object[s]."

A select group within the auto class also takes the overwhelming majority of air trips. Four million Americans account for 41 percent of domestic trips. Each mile traveled by air uses more energy than one traveled by car, so jet-setters consume six-and-a-half times as much energy for transportation as do others in the car class.

The food consumption ladder also has three rungs. At the bottom, 630 million people are unable to provide themselves with a healthy diet, estimates the World Bank. On the next rung, 3.4 billion grain eaters get enough calories and plenty of plant-based protein, giving this global middle class the healthiest basic diet.

The top of the ladder is populated by the meat eaters, who obtain close to 40 percent of their calories from fat. These 1.25 billion people eat three times as much fat per person as the remaining 4 billion, mostly because they eat so much red meat (*see the table on page 60*). The meat class pays a price in high death rates from the diseases of affluence—heart disease, strokes, and certain cancers.

The earth also pays for the high-fat diet. Indirectly, the meat-eating quarter of humanity consumes nearly 40 percent of the world's grain, since grain fattens the livestock they eat. Meat production is behind a substantial share of the environmental stresses induced by agriculture, from soil erosion to overpumping of underground water. In the extreme case of American beef, it takes 5 kilograms of grain and the energy of 2 liters of gasoline to produce 1 kilogram of steak.

The affluent diet also rings up an ecological bill through its heavy dependence on transportation. North Europeans eat lettuce trucked from Greece and decorate their tables with Kenyan flowers. Japanese eat turkey from the United States and ostrich from Australia. One-fourth of the grapes eaten in the United States are Chilean, and the typical mouthful of American food travels over 1,000 miles from farm to table. This far-flung system is only partly a product of the economics of agriculture. It is also a result of massive government subsidies for irrigation, farm policies and health standards that favor large producers, and a highway system that transfers tax burdens from truckers to other highway users.

Processing and packaging add further costs to the way the affluent eat. Even seemingly simple foods consume a surprising amount of energy: ounce for ounce, getting canned corn to a consumer takes 10 times the energy of fresh corn in season. To be sure, canned and frozen vegetables make a healthy diet easy even in winter. Of more concern are microwave-ready instant meals. Loaded with disposable pans and multilayer packaging, their resource needs are orders of magni-



Consumption of Red Meat Per Capita in Selected Countries, 1989

Country	Kilograms of Red Meat*
East Germany	96
United States	76
Argentina	73
France	66
Soviet Union	57
Japan	27
Brazil	22
China	21
Egypt	12
India	1

*Beef, veal, pork, lamb, mutton, and goat, in carcass weight equivalents.

Steel Consumption Per Capita in Selected Countries, 1987

Country	Kilograms of Steel
Bangladesh	5
Nigeria	8
India	20
Indonesia	21
China	64
Mexico	93
Brazil	99
Turkey	149
United States	417
West Germany	457
Japan	582
Soviet Union	582

tude larger than preparing the same dishes at home from scratch.

Global beverage consumption reveals a similar pattern. The 1.75 billion people at the bottom have no option but to drink water that is often contaminated with human, animal, and chemical waste. Those in the next group, nearly 2 billion people, get more than 80 percent of their liquid refreshment from clean water, with the remainder coming from beverages such as tea, coffee, and, for children, milk. At the quantities consumed, these beverages pose few environmental problems; they are packaged minimally and transport energy needs are low. In the top class once again are the billion people in industrial countries who imbibe soft drinks, bottled water, and other prepared beverages packaged in single-use containers and transported long distances. Ironically, where tap water is purest and most accessible, its use is declining. Americans drink more soda than water.

The same consumption pattern emerges with raw materials. About 1 billion rural people subsist on local biomass. Most of what they use each day—about a half-kilogram of grain, 1 kilogram of fuelwood, and fodder for their animals—could be provided by renew-

able resources. Unfortunately, landlessness and population growth often push people into fragile, unproductive ecosystems, and their minimal needs are not always met. These materially destitute billion are part of a larger group lacking many benefits provided by modest use of nonrenewables—particularly durable things like radios, refrigerators, water pipes, quality tools, and carts with ball bearings and light wheels. More than 2 billion people live in countries where per capita consumption of steel, the most basic modern material, is under 50 kilograms a year (*see the table on page 60*).

At the top of the heap is the throwaway class. A typical inhabitant of the industrialized fourth of the world uses 15 times as much paper, 10 times as much steel, and 12 times as much fuel as a Third World inhabitant. The extreme case is again the United States, where each day the average person consumes most of his or her own weight in terms of raw material flowing into the economy—18 kilograms of petroleum and coal, 13 kilograms of other minerals, 12 kilograms of agricultural products, and 9 kilograms of forest products.

In the throwaway economy, packaging becomes an end in itself, disposables proliferate, and durability suffers. Four percent of U.S. per capita expenditures on consumer goods go for packaging—\$225 a year. Each year, Americans toss away 180 million razors, enough paper and plastic plates and cups to feed the world six picnics, and enough aluminum cans to make 6,000 DC-10s. Likewise, the Japanese dispose of 30 million single-roll cameras each year, and the British dump 2.5 billion diapers.

Where disposability and planned obsolescence fail to accelerate the trip from cash register to junk heap, fashion sometimes succeeds. Most clothing goes out of style long before it wears out. Kevin Ventruolo, chief financial officer of L.A. Gear, whose sales multiplied 50 times over in four years, told the *Washington Post*, "If you talk about shoe performance, you only need one or two pairs. If you're talking fashion, you're talking endless pairs of shoes."

In transportation, diet, and raw material use, as consumption rises so does waste—both of resources and of health. Bicycles and public transit are cheaper, more efficient, and healthier transportation than cars. A diet founded on the basics of grains and water is gentle to the earth and the body. And a lifestyle that fully uses raw materials for durable goods is ecologically sound while providing many modern comforts.

Yet few who can afford high consumption opt to live simply. What prompts us to consume so much?

The Cultivation of Needs

"The avarice of mankind is insatiable," wrote Aristotle, providing one obvious answer to why people never seem satisfied with what they have. A century before Christ, the Roman philosopher Lucretius wrote, "We have lost our taste for acorns. So [too] we have aban-

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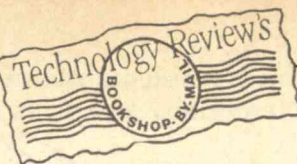
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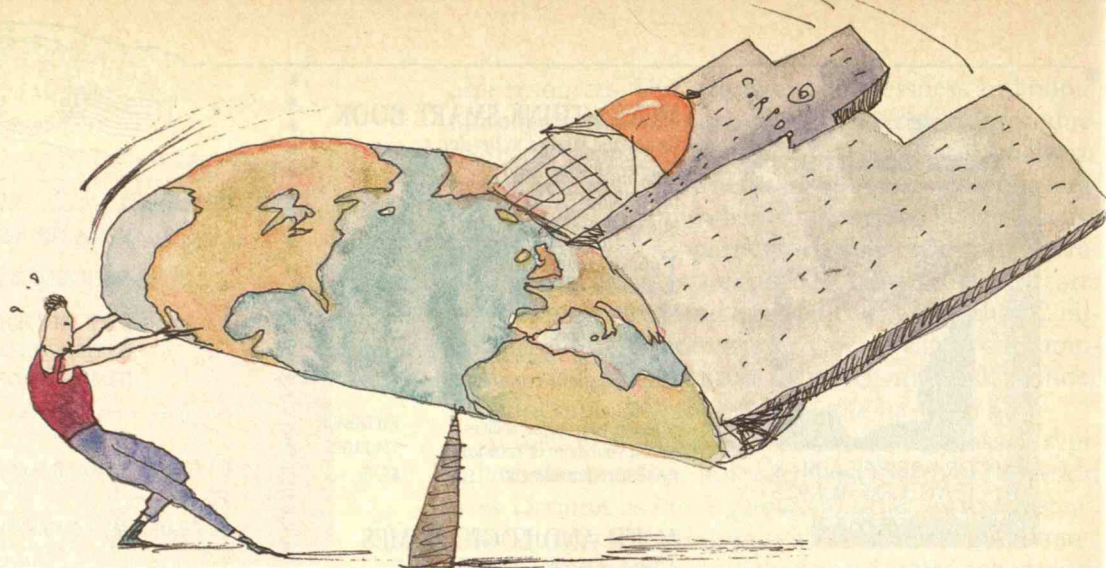
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done those couches littered with herbage and heaped with leaves. So the wearing of wild beasts' skins has gone out of fashion. . . . Skins yesterday, purple and gold today—such are the baubles that embitter human life with resentment.” Nearly 2,000 years later, Leo Tolstoy echoed Lucretius: “Seek among men, from beggar to millionaire, one who is contented with his lot, and you will not find one such in a thousand.”

Some would say that what distinguishes modern consuming habits from those of interest to Lucretius and Tolstoy is simply that we are richer than our ancestors. There is a great deal of truth in that view, but there is also reason to believe that certain forces encourage modern people to act on their consumptive desires as never before.

In the anonymous mass societies of advanced industrial nations, daily interactions with the economy lack the face-to-face character prevailing in local communities. Traditional virtues like integrity, honesty, and skill are too hard to measure to serve as yardsticks of social worth. By default, they are supplanted by a simple, single indicator—money. As a Wall Street banker put it bluntly to the *New York Times*, “Net worth equals self-worth.”

The satisfaction derived from money does not come from simply having it. It comes from having more of it than others do, and from having more this year than last. Thus, the bulk of survey data reveals that the upper classes in any society are more satisfied with their lives than the lower classes are—but no more so than the upper classes of much poorer countries.

More striking, the main determinants of happiness are unrelated to consumption: prominent among them are satisfaction with family life, followed by satisfying work, leisure, and friendships. Yet when alternative measures of success are unavailable, the human need for respect is acted out through consumption. Buying proves self-esteem—“I’m worth it,” chants one ad slogan.

Beyond social pressures, the affluent live enveloped in pro-consumption advertising. One analyst estimates that the typical American is exposed to 50 to 100 ads

each morning before 9:00 a.m. In their weekly 22-hour diet of television, American teenagers are typically exposed to 3 to 4 hours of ads a week, or at least 100,000 ads between birth and high school graduation.

Marketers have found ever more ways to push their products. Advertisements are broadcast by over 10,000 U.S. television and radio stations, towed behind airplanes, plastered on billboards, and bounced from satellites. They are piped into classrooms and doctors’ offices, woven into the plots of films, mounted in bathroom stalls, and played back between rings on public phones in the Kansas City airport. The Viskase company of Chicago offers to print edible slogans on hot dogs, and Eggverts International uses a similar technique to advertise on eggs in Israel.

Advertising has been one of the fastest-growing industries during the past half-century. In the United States, ad expenditures rose from \$198 per capita in 1950 to \$498 in 1989. Global advertising expenditures rose from an estimated \$39 billion in 1950 to \$237 billion in 1988, and per person advertising expenditures grew from \$15 to \$46 (see the chart on page 64). In developing countries, the increases are astonishing. Ad billings in India jumped fivefold in the ’80s.

Mall design itself encourages acquisitive impulses, many critics believe, but perhaps more important, suburban malls and commercial strips suck commerce away from downtown and neighborhood merchants. Shopping by public transit or on foot becomes difficult, auto traffic increases, and sprawl accelerates. In the end, town squares and city streets are robbed of their vitality.

Particularly in the United States, shopping seems to have become a primary cultural activity. Some 93 percent of American teenage girls surveyed in 1987 deemed shopping their favorite pastime. That year, the 32,563 shopping centers in the country surpassed high schools in number. Shopping centers now garner 55 percent of U.S. retail sales, compared with 16 percent in France and 4 percent in Spain.

But even in Europe, shopping centers are proliferating. Britain’s one-stop superstores doubled to about 500

in the '80s. Italy recently relaxed controls on mall development, leading to predictions that its shopping centers will multiply from 35 to 100 in five years. Spain's 90-odd centers are expected to triple in number by 1992.

Countless government policies also promote high consumption and worsen its ecological impact. Urban and transport planning favor private motorized vehicles to the exclusion of cleaner modes. Most governments in both North and South America subsidize beef production on a massive scale. Land-use and materials policies in most of the world undervalue renewable resources and underprice raw materials extracted from public domains.

More fundamentally, national economic goals are built on the assumption that more is better. For example, national statistics refer to people more frequently as consumers than as citizens. Economic policy, because it is based on a system of accounting that ignores the depletion and pollution of natural resources, views as healthy growth what is often feverish and debilitating overconsumption.

Finally, the sweeping advance of the mass market into realms once dominated by families and local enterprises has made consumption far more wasteful. In the past, a recycling ethos was built upon a materials economy that valued things and embodied that value in institutions. Not long ago—and to this day in nonindustrial regions—ragpickers, junkyard dealers, scrap collectors, and dairy deliverers kept used materials and containers flowing back into the economy.

Today, flush with cash but pressed for time, households opt for the questionable "conveniences" of prepared foods, miracle cleaners, and disposable everything. While saving time, this costs the earth dearly and changes the household from the primary economic unit to a passive, consuming entity.

Like the household, the community economy has atrophied under the blind force of a money economy. Shopping malls, superhighways, and strips have replaced corner stores, local restaurants, and neighborhood theaters—the very things that help create a sense of common identity and community. Traditional vegetable stands and fish shops in Japan are giving way to supermarkets and convenience stores. Along the way, Styrofoam and plastic film have replaced newspaper as fish wrap. Even in France, with its legendary passion for fresh foods, the microwave and *grande surface* (shopping mall) are edging out bakeries, dairies, and farmers' markets.

The search for status in massive and anonymous societies, omnipresent advertising, a shopping culture that edges out alternatives, government biases favoring consumption, and the spread of the commercial market

into private life all nurture acquisitive desires. Can we, as individuals and as citizens, confront these forces?

A Culture of Permanence

When Moses came down from Mount Sinai he could count the rules of ethical behavior on his hands. In our complex global economy, in which the simple act of turning on an air conditioner sends greenhouse gases into the atmosphere, the rules for ecological living run into the hundreds. Even so, the basic value of a sustainable society, the ecological equivalent of the Golden Rule, is simple: each generation should meet its needs without jeopardizing the prospects of future generations.

Lacking in consumer society is practical knowledge of what it means to live by that principle. Environmental ethics will arrive when most people think first of the pollution a large car causes, not the status it conveys. In a fragile biosphere, humanity's fate may depend on whether we can cultivate deeper sources of fulfillment, founded on an ethic of limiting consumption and finding nonmaterial enrichment.

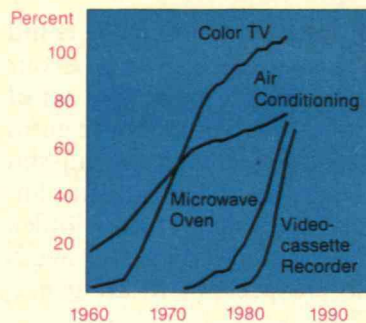
For individuals, the decision to live a life of sufficiency—to answer the question "How much is enough?"—is to begin a highly personal process. The goal is to put consumption in its proper place among the many sources of personal fulfillment, and to find ways of living within the means of the earth. One inspiration in this quest is the body of human wisdom. All the sages, from Buddha to Muhammad, denounced materialism. "What shall it profit a man," the Bible asks, "if he shall gain the whole world and lose his own soul?" As Arnold Toynbee observed, "Religious founders all said with one voice that if we made material wealth our paramount aim, this would lead to disaster."

People often find that simpler living offers its own rewards. Many people find a sense of purpose in working to foster a just, sustainable world. Others describe the way simpler technologies add unexpected qualities to life. Some come to feel, for example, that clotheslines, window shades, and bicycles have a utilitarian elegance that clothes dryers, air conditioners, and automobiles lack. These modest devices are silent, manual, climate-friendly, easily repaired, and inexpensive. Vicki Robin, president of the Seattle-based New Road Map Foundation, which offers courses on getting off the more-is-better treadmill, notices that those who succeed in her program always have "a sense of purpose larger than their own needs, wants, and desires."

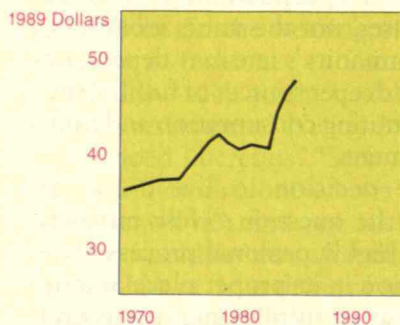
Still, shifting emphasis from material to nonmaterial satisfaction is no mean feat: it means trying both to curb personal appetites and to resist the external forces

Each generation should meet its needs without jeopardizing future generations.

U.S. Household Ownership of Appliances, 1960-88



World Advertising Expenditures Per Capita, 1970-88



al controls. The goal of creating a sustainable culture—a culture of permanence—is a task that will occupy several generations.

Personal restraint will do little if not wedded to bold political steps against the forces promoting consumption. In addition to the oft-repeated agenda of environmental reforms, action is needed to restrain the excesses of advertising, curb the shopping culture, abolish policies that push consumption, and revitalize household and community economies as human-scale alternatives to the high-consumption lifestyle.

The advertising industry is a formidable foe, but it is already vulnerable when it pushes products dangerous to human health. Tobacco ads are or soon will be banished from television throughout the West, and alcohol ads are under attack as never before. In 1990, Congress wisely hemmed in TV commercials aimed at children, and the European Community's standards after 1992 will put strict limits on some types of TV ads.

At the grassroots level, the Vancouver-based Media Foundation has set out to turn television to anti-consuming ends. Their "High on the Hog" campaign shows an animated pig frolicking on a map of North America as a narrator intones: "Five percent of the people in the world consume one-third of the planet's resources. . . . Those people are us." The Media Foundation is on target: in a culture of permanence, commercial television will need a fundamental reorientation.

encouraging consumption. As Davidson College historian David Shi chronicles, the call for a simpler life has been perennial in North America, from the Puritans to the back-to-the-landers of the 1970s. None of these movements gained many adherents.

But while it would be naive to believe that entire populations will suddenly experience a moral awakening, renouncing greed, envy, and avarice, what can be hoped for is a gradual weakening of the consumerist ethos. The challenge is to bring environmental matters under cultur-

Some countries have resisted the advancing shopping culture (though only rarely is the motive to oppose consumerism itself). England and Wales have restricted Sunday trading for 400 years, and labor groups beat back a recent proposal to lift those limits. Similarly, protected green belts around British cities have slowed the development of malls. German stores must close most evenings at 6:00 and have limited weekend hours as well. Most Japanese still shop in neighborhood lanes that are closed to traffic during certain hours to become *hokoosha tengoku*—"pedestrian heavens."

Direct incentives for overconsumption are also essential targets. If prices reflected something close to the environmental cost of production, through revised subsidies and tax systems, the market would guide consumers toward less damaging consumption. Disposables and packaging would rise in price, and local unprocessed food would cost less.

Ultimately, efforts to revitalize household and community economies may prove decisive in the attempt to create a culture less prone to consumption. At a personal level, commitment to nonmaterial fulfillment requires reinforcement from family, friends, and neighbors. At a political level, strong local institutions may be the only counterweight to the colossus of vested interests that benefit from profligate consumption.

Despite the ominous scale of the challenge, many more people could be ready to begin saying "enough" than prevailing opinion suggests. After all, much of what we consume is wasted or unwanted. How much of the packaging in trash would we rather never see? How many of the unsolicited sales pitches in the post are nothing but junk? How much newspaper advertising would we not gladly see left out? How many miles of driving would we not give up if livable neighborhoods were closer to work, a variety of merchants closer to home, streets safe to walk, and public transit faster? How much of the rural land being built up into housing developments, industrial parks, and commercial strips could be left alone if we planned land use better inside city limits?

In the final analysis, we might be happier with less. Accepting and living by sufficiency rather than excess offers a return to the human cultural home: to the ancient order of family, community, good work, and good life; to a reverence for skilled handiwork; to a true materialism that cares *for* things, not just *about* them.

For the lucky, a human life encompasses perhaps a hundred trips around the sun. Regardless of religion, the sense of fulfillment received on that journey has to do with the timeless virtues of discipline, hope, allegiance to principle, and character. Consumption has little part in the play that inspires the young or the bonds of love and friendship that nourish adults. The things that make life worth living, that give depth and bounty to human existence, are infinitely sustainable. ■

Getting University-Industry Relations Right

CONCERN about the decline in performance of U.S. industry relative to foreign competition has created a demand for more collaboration between universities and industry. The resulting new activities not only broaden the fundamental mission of the university from the acquisition and dissemination of knowledge to its application but also present to universities their most exciting intellectual opportunity in decades.

But this burgeoning attention to university-industry cooperation also raises important questions about ownership of intellectual property, publication policy, and open access to research in progress. Conflict-of-interest questions come up, too; in biomedical research, for example, there is growing concern about faculty who consult for companies on topics related to their industry- or government-sponsored research. Unfortunately, much of the current public debate on these new collaborations focuses unduly on these problems and not enough on the long-range opportunities.

The new interest in university-industry relations has arisen because U.S. industry has seemed unable to translate new technology into quality products. This concern is heightened by the increasing speed with which certain critical technologies—electronics, materials, and biotechnology—must progress from invention to commercial production if they are to succeed in the market.

Awareness of this shortcoming has led to significant responses from universities, industry, and government. Industry is showing greater interest in collaborating with universities, especially in rapidly developing fields that look economically rewarding. MIT, for example, receives industry support for research on high-temperature superconductivity, manufacturing technology, and biotechnology. The government encourages such collaborations, and increasingly justifies programs on the basis of their contribution to the competitiveness of U.S. industry.

Spurred by these changed circumstances and by the expressed national need, research universities are beginning

to formulate new education and research programs. Such programs, often underwritten by industry, offer a new pathway that motivates and prepares students for the application, not just the creation, of new technology.

Instead of concentrating exclusively on a particular academic discipline, students following this new pathway address major technology applications and manufacturing issues in a way that integrates design, engineering, and production management. One example is the MIT Leaders for Manufacturing Program, a collaboration between MIT's schools of engineering and management and 12 companies that sponsor joint research and education to improve the use of technology.

One problem with these collaborations stems from the federal government's attitude toward them. Many university-based research programs focus on emerging technologies that have long-term com-

mercial potential. But in attempting to justify their budget requests to Congress, agencies oversell the potential for quick payoff. This emphasis can hamper creative collaborations. Both the Department of Energy and the National Science Foundation, for example, stress technology transfer to industry as a principal aim of their research programs. As a result, Congress naturally finds it reasonable to restrict access to such research projects by foreign students and companies, and has confined its debate to protectionism and potential conflicts of interest.

It is time for Congress to redirect this debate to the long-term benefits that can come from university-industry collaborations—as well as from joint projects involving government laboratories. We need legislation that encourages greater cooperation among these three sectors. In addition, universities should set specific goals for increasing their work with industry. MIT, for example, now gets about 12 percent of its funding for on-campus research from industry. A reasonable target would be to raise this to 25 percent over the next 5 to 10 years.

Policymakers should recognize that these collaborations will yield long-term benefits only if certain simple standards are met. One is that the research have potential for technology transfer. More important, the research must seek advances in basic understanding. Finally, the industry-sponsored project should have a significant education component. One collaboration that meets these criteria is the program to study the use of high-temperature superconductors for electron-



ics, which MIT has undertaken in partnership with IBM and AT&T.

For their part, universities—not government—should establish clear rules to preserve the openness of the research process and to avoid conflicts of interest on the part of faculty. If U.S. industry and universities work together to establish joint R&D programs that meet these standards, I am convinced that the nation will benefit greatly. ■

JOHN M. DEUTCH, an Institute Professor of chemistry, is the former provost and dean of science at MIT. He has also been undersecretary of the Department of Energy and director of energy research.

A Victory for Computer Populism

WHAT will become of human freedom in a thoroughly computerized world? Debates on the topic have raged since the 1950s as computers spread into every corner of society. Some believe that computers are destined to enhance liberty by giving citizens easy access to information they need to govern their public and private lives. Others warn that computers are ready tools for regimentation, surveillance, and dangerous concentrations of power.

An astonishing chapter in this ongoing controversy surfaced earlier this year, when the computer as social menace tangled with computer democracy. The confrontation arose as Lotus Development Corp. prepared to release a potent piece of software called Lotus MarketPlace: Households. The package was to have been a database on 120 million Americans, containing their names, addresses, estimated incomes, consumer preferences, and other personal details. Using information compiled by Equifax Inc., MarketPlace was designed to run on compact discs for Apple Macintosh computers at a base price of \$695. Information once located in a few highly centralized databases would now be scattered throughout the land in an inexpensive program for personal computers.

In January, however, Lotus and Equifax suddenly announced that MarketPlace would be withdrawn. Rumors about the product had attracted 30,000 inquiries from people alarmed about privacy, asking that their names and personal information be removed from the database. Company officials scuttled the program rather than face citizens' ire.

This intense opposition sprang in part from inquiries by Computer Professionals for Social Responsibility (CPSR), a public-interest organization. During a demonstration of the Lotus product last summer, Marc Rotenberg, director of CPSR's Washington, D.C., office, was dismayed to learn that MarketPlace offered no protection for personal identities. Users could examine specific names and addresses, not just aggregate survey data. "You could ask for a list of single women over the age of

65 living in Revere, Massachusetts, and MarketPlace would obligingly produce it," Rotenberg observed.

Consumer groups and professional associations began studying MarketPlace and its disturbing features. How would individuals be protected from possible infringements of privacy? How would errors in the database be eliminated? Lotus tried to allay fears, explaining that the product would be sold only to "legitimate businesses" and that persons who did not wish to be included in the database could write Lotus and make their wishes clear.

When CPSR looked into the matter, however, they made a fascinating discovery. To delete yourself from the database, you had to supply Lotus with your Social Security number. That suggested that information in the Equifax database was keyed to Social Security numbers. Hence, the nightmare envisioned by Sen. Sam Ervin years ago—that the Social Security

lamented that there had been public "misunderstanding of the product." Not true. Critics fully understood the technology, business contexts, and social issues of MarketPlace and pointed out specific objectionable aspects of the program.

This firestorm of computer populism was neither planned nor centrally orchestrated. It arose spontaneously within the webs of computerized communication that let people discuss social issues as they go about their daily business. While the issue also spread by word of mouth and in newspaper stories, the ability of computer networks to amplify public response clearly played an important role.

In this battle of Liberating Network versus Menacing Database, the outcome is loud and clear. People welcome computers to the extent that they expand their ability to exchange information and ideas. They despise systems that keep track of each person's every move.



number would become a universal identifier—was about to be realized.

Meanwhile, news of the product became a hot topic on the computer networks used by university researchers and ordinary citizens. Computer conferences and electronic mailboxes buzzed with questions. Network activists called for direct action. They distributed sample protest letters on-line with the suggestion that networkers send them to Lotus headquarters. The e-mail address of Lotus president Jim Manzi was widely circulated, as was the company's 800 number. Letters, phone calls, and e-mail poured into Lotus offices.

As the dust settled, a Lotus press release

The troubles unearthed during the MarketPlace furor will not vanish with the product's ignominious death. Equifax and others continue to assemble records about our personal affairs, and will sell them to anyone willing to pay. Sooner or later we are bound to see Big Brother 1-2-3 reborn. When that happens, citizens of the network will have to rise up again, fighting back with all the ingenuity and vigilance they showed this time around. ■

LANGDON WINNER teaches in the Department of Science and Technology Studies at Rensselaer Polytechnic Institute. His most recent book is The Whale and the Reactor.

Reviews

BOOKS

WHAT COMPUTERS DON'T KNOW

Artificial Experts: Social Knowledge and Intelligent Machines
by H.M. Collins
MIT Press, \$19.95

BY WILL WARNER

SUPPOSE that midway through a game of chess a novice player enlists the help of an "expert system"—in this case, a chess-playing computer program. The first time she asks the computer to recommend a move, the computer asks her where the chessmen are on the game board. She can answer this question because even a novice knows this much about the game.

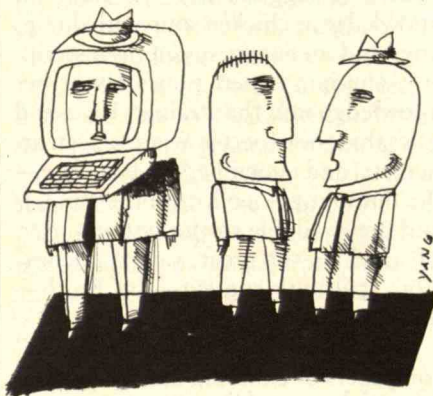
But the computer then surprises her by asking, "Has your opponent demonstrated a willingness to exchange pieces of equal point value?" Now the novice starts to sweat, because she doesn't know what that means. Presumably the computer will base its recommendation on her answer, so she begins to wonder whether she can trust its advice. Her doubt is all the worse because she is not skilled enough even to gauge the fitness of the advice she receives.

The novice has just run up against a flaw common to many expert systems: you have to be an expert to use them with confidence. Computer programs designed to substitute for human experts assist with everything from medical diagnosis in hospitals to selecting pipe hangers in power plants. When people ask human experts for answers and advice, the experts typically respond with a number of inquiries to establish context, then give the answers. Users of expert systems expect them to make the same clarifying inquiries and give the same advice as human experts.

H.M. Collins, a sociologist at the

University of Bath, in Great Britain, has pondered the extent to which that expectation is justified. In *Artificial Experts: Social Knowledge and Intelligent Machines*, he acknowledges that artificial experts can aid human experts. But he predicts that in the hands of ordinary people, they will show crippling limitations. The reason, he writes, is that "the locus of knowledge appears to be not in the individual but the social group."

Certainly, teaching and learning are



highly social activities—but *knowing*? To justify this assertion, Collins points out that knowledge and belief are matters of social consensus. Scientists, especially, agree to pursue knowledge, phrase their inquiries, and judge their results in certain ways. They apply aesthetic criteria to their work. An "ugly" theory, even if it fits the facts, is doomed to a short life because scientists will be uncomfortable believing it.

This phenomenon may explain why scientists usually find religious cosmologies unconvincing. God, in the language of science, is a weak theory. The problem is that the god theory makes no testable predictions. Consequently, not only is there no contrary evidence at hand, there *cannot* be any. Scientists can never disprove propositions like this, and generally have no time for them. Hence a theory may be ruled out by social consensus—in this case by the conventions of science.

Once our beliefs have formed, they undergo another social process that Collins calls "routine servicing." Contact with other knowers keeps us on

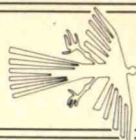
track and up to date. Without it, we might "drift away from the habits of thinking and seeing that make up the . . . culture."

Expert systems, however, are isolated repositories of knowledge. Their isolation stems in part from how they come to know what they know. They get their knowledge from engineers, who get it through interviews with human experts. As a result, expert systems know only what people can *say* about their knowledge. And as Collins discovered after a long and largely unsuccessful effort to elicit the knowledge of an expert in an esoteric subject, human experts know much more than they can say.

The part of their knowledge that people can't articulate—which may nevertheless be indispensable—they learn and pass on through social intercourse. People appear to learn more by "show" than by "tell": we absorb knowledge through constant exposure to what everybody else knows, which we infer from what everybody else does. "Through our masters," Collins writes, "we are apprenticed to society."

To help make his point, the author turns to a famous thought experiment originally proposed as a test for artificial intelligence. The Turing test asks us to imagine an interrogator using type-written conversation to determine which of two conversational partners is a *man* pretending to be a woman and which is a *computer* pretending to be a woman. Because the test is posed as a competition between two things mimicking something else, Collins wonders if it was "deliberately designed to conceal the contribution of socialization."

A man pretending to be a woman can know only so much about women because he has never lived life as one. His knowledge is "grainy" while a woman's knowledge of herself is "smooth" or "dense." Having a man imitate a woman bars some of what a person knows by virtue of socialization. This helps even the odds between the man and the machine, which also has not lived life as a woman.

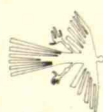


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Collins contends that we do not (and certainly should not) similarly even the odds for expert systems. In their bid to play a role in society, artificial experts have only grainy, formal, textbook knowledge, while human experts also have the dense component of knowledge that arises in those who live in society. We do not deprive human experts of their socialization to make it easier for the computers to perform equally well. Hence, if Collins is right, they *won't* perform equally well.

Collins suggests that we think of knowledge as chicken soup with dumplings and an expert system as a strainer. A human expert pours his or her knowledge into the strainer. Facts and rules that the expert is aware of, can articulate, and remembers to articulate—the dumplings—collect in the strainer and are available to the system's user. Meanwhile, the great, vague, unconscious cultural context—the broth—passes through and is lost.

Unless we can somehow "socialize" computers by enabling them to participate in society, they will not be good substitutes for humans except in certain kinds of activities. The book goes on to describe what makes an activity a good candidate for such "computerization." "Whenever we choose to mimic a thing," the author writes, "a thing can mimic us." In other words, when we define a task so narrowly that we can perform it with much less than our full human capacity, we make the task suitable for a machine.

Here Collins makes a critical distinction between action and behavior. Action is "intended" and thus requires more knowledge than behavior does; it may even require intuition, which is perhaps a vapor of the knowledge soup. Behavior accompanies action; it's what we see when someone acts. Because it does not require "intention," it's relatively easy to mimic. For example, the act of painting car bodies on an assembly line requires different behavior for each body style. When a wholly new kind of car comes down the line, human painters can paint it because they are performing the *act* of painting. They

have not only the perception and manual dexterity but also the painting skill, which enables them to develop the appropriate behavior for achieving their goal as circumstances change.

Car-painting robots (essentially expert systems that respond with deeds instead of words) merely record and play back behavior. Because they don't take on the *act* of painting, they must be taught new behavior each time they encounter a different model. Someday robots may possess the perception and dexterity to find all the nooks and crannies in any car body. Even then, human painters will be able to impart to them only their formal knowledge and rules of thumb, not their smooth, partly unconscious skill. The machine's knowledge will still be grainy. But will it nevertheless produce behavior within tolerance? The same question must be asked of expert systems.

Collins's answer is that the effectiveness of expert systems will depend on who's using them. Human and artificial experts in the same field can enjoy a profitable rapport because the human compensates for gaps in the machine's knowledge. The human supplies the knowledge-broth and needs only an occasional dumpling as a reminder—which the computer dutifully furnishes.

But for humans of lesser and lesser knowledge, the computer's knowledge must rise to compensate. The computer can "tell" but not "show," and it cannot watch for the light to come on in the human's eyes. At some point, then, the burden on the computer becomes too great, and the expert system's attempt to take the place of a human fails.

If Collins's "soup" theory is correct, it may challenge the way we think about knowledge. As it is, we tend to undervalue our everyday knowledge, perhaps because it is so widely distributed and unconsciously employed. Abstract, textbook knowledge gets all the respect. For at least 100 years, physics, the original exact science, has been the model of knowledge. The physicist Lord Kelvin spoke for science when he said knowledge is weak unless we can express it in numbers.

Statements like this have produced a phenomenon known as "physics envy," which drives practitioners of the soft sciences to reduce their fields to equations. The Harvard Business School, for example, assumes that people armed only with the formal knowledge of business management can successfully run any kind of business.

Collins would probably say that many things are not amenable to the Harvard Business School approach. Scientists, for example, "discover they cannot do without their technicians; they cannot substitute their formal knowledge for practical experience."

Few engineers or scientists would disagree completely. Nevertheless, many will continue to esteem formal knowledge and be skeptical of the "knowledge soup." Engineers, especially, know that they would accomplish nothing without numbers. As for scientists, "knowledge soup" may remind them of another all-pervading, impalpable, infinitely fine, and homogenous broth—the ether, which was formerly postulated as a medium for the propagation of light. Like knowledge soup, the ether seemed plausible and performed well in its imagined role, but it turned out not to possess the additional virtue of being real. ■

WILL WARNER is a writer and computer engineer in Ann Arbor, Mich.

BOOKS

SOVIET DISUNION

Science and the Soviet Social Order

Edited by Loren R. Graham
Harvard University Press, \$35

BY KAREN ROSENBERG

WESTERNERS have tended to view Soviet science as a state-directed monolith. To be sure, the face it presented before glasnost was often doctrinaire, marked by an uncritical cult of large-

scale technology, including nuclear power and space exploration. But *Science and the Soviet Social Order*, a collection of essays edited by Loren R. Graham, a professor in MIT's Program in Science, Technology, and Society, points out many of the complexities missing from popular Western conceptions. Through articles originally delivered as papers in Cambridge, Mass., at the Coordinated Research Center on the Humanistic Dimensions of Science in the USSR, the book shows that nonconformist scientific views have indeed been expressed, even before glasnost. You just have to know where to look.

According to Paul Josephson, a historian and political scientist, Soviet newspapers and general-interest magazines before Gorbachev rarely aired trenchant ethical arguments about the uses of technology. Nor did journals in philosophy or medicine tend to

scrutinize the ethics of Soviet science, write philosopher Richard T. De George and political scientist Bruce J. Allyn. But chapters such as those by science historian Mark Kuchment on popular science writing, by social historian Richard Stites on science fiction, and by art historian Peter Nisbet on the visual arts draw attention to genres that have questioned the morality of Soviet science, albeit in coded language intelligible mainly to the initiated.

That various artistic media contained critical thought will not surprise anyone who knows Soviet or ex-Soviet scientists, since many of them show a deep interest in culture. Although in some cases the arts have provided an escape from current problems, they have also been among the few outlets for debate on social issues, including those related to science and technology. Katerina Clark, a Yale literary historian, makes

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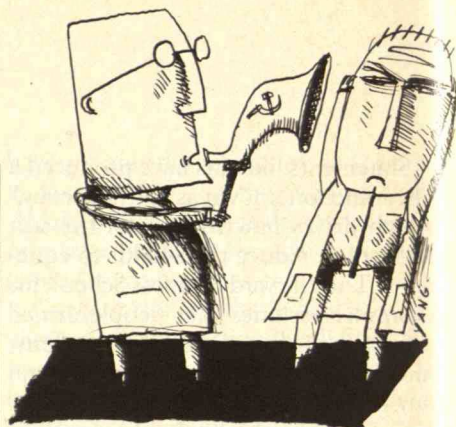
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REVIEWS



it clear that "anti-urbanist" writers challenged the assumptions of technology enthusiasts in Soviet fiction of the early 1920s. And while Stalin-era fiction celebrated projects like hydroelectric dams, Clark shows that it also included novels and short stories on rural themes—by V. Ovechkin, V. Tendriakov, L. Leonov, and others—that attacked massive, rapid industrialization.

After Stalin, even more writers sounded the alarm. They celebrated the Russian village, writes Clark, as "a humanist's idyll, a paradise . . . which stands for wholeness in an age of alienation." In "village prose" fiction of the mid-1960s to mid-1970s, the Russian Orthodox village is guarantor of the nation's ethical values, and so must be protected from incursions of large-scale technological projects that reshape the landscape and drive people to the cities. V. Rasputin's 1976 novel *Farewell to Matyora*, for instance, laments the destruction of a town and its traditions by what Clark calls "that favorite symbol of Stalinist fiction for the new age," the hydroelectric dam.

Several articles in this collection point to another forum for minority opinions about science and technology: oral culture. Intellectuals in the West, where diverse opinions are available (albeit not always readily) in print or electronic form, may find it hard to imagine the extent to which memory, rumor networks, unifying jokes, and face-to-face conversation have been cultivated and valued in the USSR. These traditions can create an alternative system of education, prestige, and even material reward as people help each other get scarce goods, services, and jobs.

An essay by University of Pennsylvania historian Marc B. Adams explains the development of one such network in Soviet scientific circles. He observes that many mainstream Soviet scientists take the position that heredity is much more important than environment in determining mental characteristics. One Soviet scientist, for example, "has argued that altruism, heroism, self-sacrifice, conscience, respect for old people, parental love, monogamy,

chivalry, and intellectual curiosity 'have entered into the basic stock of man's inherited characteristics.'" Another claims that chronic criminality is inherited. And, Adams writes, one A.A. Neifakh has even "called on Soviet authorities to breed superior people."

To explain how such views have persisted in the Soviet Union long after being discredited in the West, Adams points to an informal alliance that developed in the 1930s between geneticists and eugenists. Under Stalin, both types of researcher were calumniated as "fascists." Some were arrested, shot, or exiled, and a number of their research institutes were closed. A common enemy—Stalin and Stalinism—created a common front out of two groups that might otherwise have argued heatedly. Banned from some research establishments, they helped one another find shelter in other Soviet institutions.

Even after Stalin, says Adams, they faced continued discrimination and so banded together to find employment, relying on school, family, and other ties that "cannot be seen in organizational charts or in the published paper trail." Presumably, Adams is suggesting that Soviet scientists today might be more critical of theories about the breeding of human mental characteristics if debate between geneticists and eugenists had not been suppressed in the Stalin era. In other words, eugenic and extreme hereditarian arguments might have been debunked in the Soviet Union just as they were elsewhere after the Nazi experiments and theories.

The sort of informal oral culture that sustained eugenics and genetics through many difficult years is one medium in which nonconformist scientific views have found expression in the Soviet Un-

on. But in some fields, Soviet scientists have found it easier to challenge official doctrine through formal channels such as published papers. According to Douglas Weiner, a historian at the University of Arizona, one such field is ecology. Since Stalin's death in 1953, he suggests, ecology has been an important front in scientists' fight for more power and influence in Soviet society.

In 1956, as the post-Stalin thaw became more noticeable, pollution by pesticides and radiation became an issue at a conference at the Leningrad Zoological Institute and in an academic journal of conservation. Although the idea that industrialization can seriously harm the environment was controversial in the USSR of the 1970s, by the mid-1980s even one of Gorbachev's advisers, philosopher I. Frolov, was debunking the myth that nature is inexhaustible. And starting in the late 1970s, scientists such as biologist N. Reimers formulated and promoted plans to preserve the Soviet environment, including an ambitious scheme to defend and improve the USSR's system of "protected territories."

Weiner's article is clearer and easier to follow than most of the essays in this volume, which assume considerable familiarity on the part of the reader with Russian history, culture, and politics. In this regard, the book as a whole has missed an opportunity to reach an audience for whom it would have been extremely beneficial: Western scientists.

If glasnost continues, more and more U.S. and West European researchers will have contact with their Soviet counterparts and with emigrant scientists from the USSR. A book on science and the Soviet social order could smooth the way for such contacts, ushering Westerners beyond simplistic Cold War stereotypes by showing that scientific culture in the Soviet Union is more complex than meets the eye. But this volume, with its innumerable unexplained references to people and events, will probably be read almost exclusively by other academics in Soviet studies. ■

KAREN ROSENBERG, who has a PhD from Yale in Slavic literature, writes frequently on Soviet culture.

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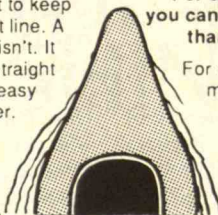
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Notes

Competition and Unions

According to an Economic Policy Institute study, no statistics support the idea that labor unions have made U.S. firms—especially in auto and steel—less competitive. If anything, Thomas Karier concludes, higher wages and unionization rates go hand in hand with the high levels of capital investment that characterize countries with good productivity growth and competitiveness.

If unions were a disadvantage, they would impede highly unionized producers the most, Karier explains. But Japan, Canada, and West Germany, which account for 63 percent of the U.S. trade deficit, have higher unionization rates. Moreover, the U.S. decline internationally occurs just when its unionization rate is the lowest in 40 years.

Old Corn

Genetic analysis of corn from Anasazi ruins in Utah strongly suggests Indians knew how to hybridize corn 800 years ago. Such analysis is often used to easily identify modern corn hybrids.

University of Arizona plant scientist Tim Helentjaris tested DNA from corn cobs collected near the Four Corners area of southern Utah and found signs of identical hybridization in five out of eight samples. Helentjaris says the only obvious explanation is that Anasazi consciously hybridized corn and grew it at each location.

He calls the find intriguing but not surprising. "It's naive to believe the same people who made sophisticated observations of the stars were incapable of recognizing corn hybridization when they saw it."

Abling Machinery

Disabled people could benefit from three low-cost devices designed by University of South Carolina mechanical engineering students. The prototypes will be given to a nonprofit or minimal-profit organization capable of bringing them to market.

A three-wheel vehicle is ready for production after five years of work—done each year by students who improved on the previous year's prototypes. Also available are an automatic door opener that can be built and sold for about \$400—a third or less of what existing systems cost—and a switch to help children who have cerebral palsy play with toys and other battery-operated devices.

Root Talk

Botanists at the University of California at Santa Barbara have evidence that plant roots can communicate. Bruce Mahall and Ragan Callaway let the roots of burro weeds grow through those of creosote brush. The researchers tested all combinations of the two shrubs and measured the growth every other day.

When two burro weed root systems touch, they apparently detect and avoid each other, Mahall notes. The systems also distinguish between burro roots and others. Creosote brush roots inhibit the growth of both other creosote brush plants and burro weed plants.



Kudzu Karma

Sakae Bio, Inc., of Japan plans to build a kudzu farm and processing plant on 165 acres of Alabama pasture, reports the *Atlanta Constitution*. Introduced to the United States at the 1876 Centennial Exposition, "the weed that ate the South" now blankets about 2 million acres, covering trees, utility poles, and vacant houses.

Asians have used a powdered starch extracted from wild kudzu for hundreds of years in gourmet confections, beverages, and herbal remedies. But demand far outstrips supply in Japan, since farmland is expensive. So Sakae Bio will cultivate kudzu in Alabama and ship starch back across the Pacific. And the lack of machines for kudzu harvesting is no problem. Notes Auburn University agronomist Charles Mitchell, "If there is a profit to be made, we can come up with the machinery."

Death in the Forest

Forest damage will cost Europe at least \$30 billion annually over the next 100 years unless drastic measures to curb sulfur emissions are enacted, reports the International Institute for Applied Systems Analysis, a Vienna-based research organization supported by scientific academies.

"The value of annual forest losses from sulfur pollution alone is about three times as much as Europe's political leaders have committed to spend each year to control air pollution," says forest researcher Sten Nilsson. Even strong steps are "probably too late for some forests in Czechoslovakia and the eastern regions of Germany, which will simply die over the next decade."



Green Machine

Harvest Polyol has built a personal computer in which all plastic parts are vegetable-based, reports Environment News Service. Polyol, the basis of polyurethane, is usually made from petroleum but can also come from almost any oil—cottonseed, fish, palm.

The British firm's vegetable-polyol manufacturing unit fits in a 40-foot container that can be trucked to wherever feedstock grows. And the only effluent is water vapor, so people can work inside safely without masks. Moreover, a "polyconcrete" twice as strong as ordinary concrete can be made by combining the polyol with fuel ash from coal-fired power stations.

Close Quarters

Put U.S., Japanese, and European astronauts in a space station, and cultural differences could mean high confusion, thinks University of Illinois psychologist Harry Triandis. "We need to look at what sorts of problems they may encounter, and then train [astronauts] on how to handle them."

Astronauts must learn to distinguish between cultural and personal differences, says Triandis, an adviser to NASA on training diverse crews for a space station. "Very often it is not a cultural difference that is causing a problem, but an individual who does something in his own way."



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